6070A
6071A

Synthesized RF Signal Generators

Calibration Manual

FLUKE®

6070A
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Synthesized RF Signal Generators

Calibration Manual

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FLUKE®

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John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, Washington 98206

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6070A/6071A Synthesized RF Signal Generators

Section 1
Introduction and Specifications

1-1. THE MANUAL SET

1-2. The John Fluke Models 6070A and 6071A RF Synthesized Signal Generators are documented by a set of four manuals: the 6070A/6071A Operator Manual, the 6070A/6071A Calibration Manual, the 6070A/6071A Service Manual, and the 6070A/6071A Schematics Manual, (Figure 1-1). The 6070A/6071A Operator Manual introduces the instrument; familiarizes the operator with all instrument controls, connectors, and indicators; and presents detailed operating information and procedures for both local and systems operation. The 6070A/6071A Calibration Manual provides procedures for general maintenance, performance checks, and calibration adjustments. The 6070A/6071A Service Manual describes the theory of operation and troubleshooting and include a list of replaceable parts. The 6070A/6071ASchematic manual contains a functional block diagram, wire lists, interconnection diagrams, and all schematic diagrams of the instrument.

1-3. The major difference between the two models is that the 6071A has twice the upper frequency limit of the 6070A. Because of their similarity, most of the text in this manual applies to both models. Text that applies to just the 6070A or just the 6071A is identified as such.

1-4. THE 6070A/6071A CALIBRATION MANUAL

1-5. The information in this, the 6070A/6071A Calibration Manual is divided into seven sections:

1	INTRODUCTION AND SPECIFICATIONS	Introduces the 6070A/6071A Instruction Manual set and the 6070A/6071A Calibration Manual and list the specifications of the instrument and the test equipment required to complete the performance checks and the calibration procedures.
2	SHIPPING AND SERVICE INFORMATION	Describes how to ship the instrument and how to get problems corrected.
3	ACCESS PROCEDURES	Describes the procedures necessary to gain access to each circuit inside the instrument.
4	GENERAL MAINTENANCE PROCEDURES	Describes procedures for cleaning the instrument, for selecting a different line power configuration, and for changing fuses.

5	PERFORMANCE CHECKS	Describes procedures to verify proper operation of the instrument.
6	ADJUSTMENT PROCEDURE	Describes procedures for making all routine adjustments and describes the procedure used to reprogram the Calibration EPROM.
7	PERFORMANCE CHECKS AND CALIBRATION OF OPTIONS	Describes the procedure for completing the performance checks and calibration procedures required by instruments with options installed. Each option has a separate subsection.

1-6. LIST OF RECOMMENDED TEST EQUIPMENT

1-7. The test equipment recommended for the performance checks and calibration adjustments are listed in Table 1-1. If the recommended test equipment is not available, equivalent test equipment can be used.

1-8. 6070A/6071A SPECIFICATIONS

1-9. Table 1-2 lists the specifications of the 6070A and the 6071A.

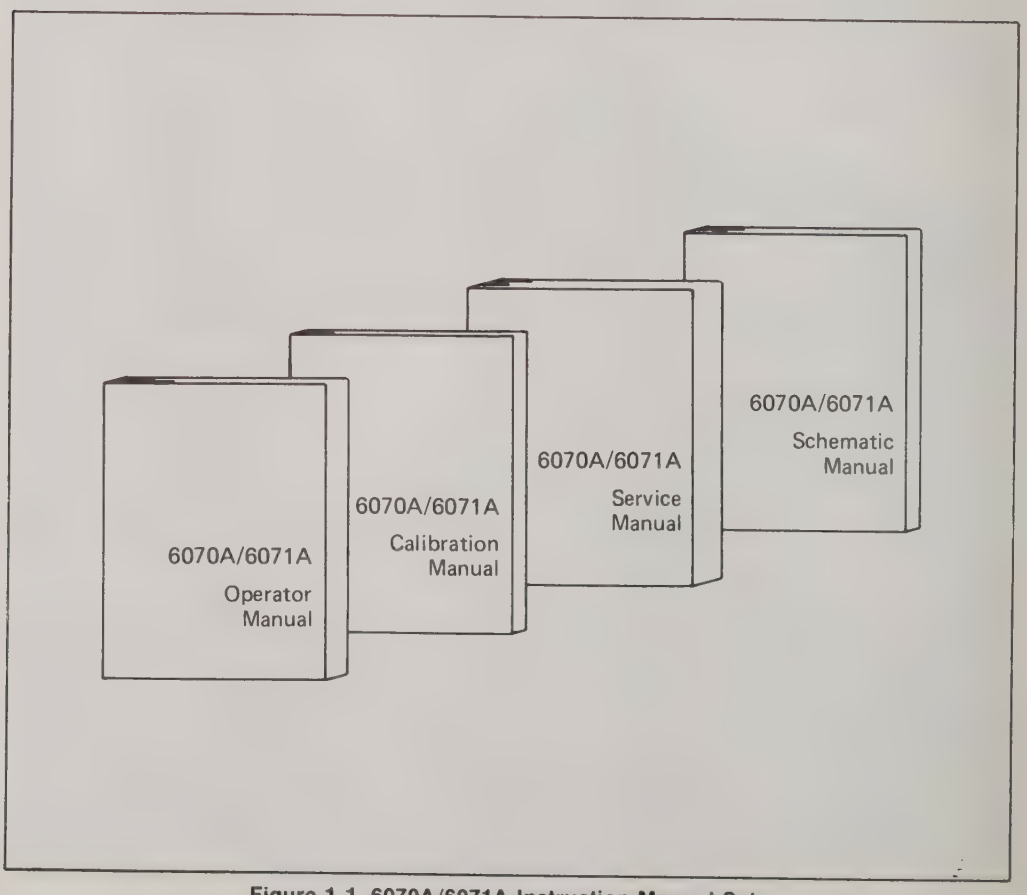


Figure 1-1. 6070A/6071A Instruction Manual Set

Table 1-1. 6070A/6071A List of Required Test Equipment

ITEM	MINIMUM USE SPECIFICATIONS	RECOMENDED INSTRUMENT
Systems DMM	Accuracy ±0, 15% at 1V rms and 3 kHz	JF 8502A with Option -09A
True RMS Voltmeter		JF 8920A
Low Frequency Spectrum Analyzer	>1 MHz, 10 Hz Resolution	TEK 7L5 with Option 25, L3
High Frequency Spectrum Analyzer	>2.1 GHz	TEK 7L13, Mod. 139U
Low Frequency Synthesized Signal Generator	>10 MHz	JF 6011A with Option -02
UHF Synthesized Signal Generator	0.2 to 1040 MHz, +13 dBm	JF 6071A
Frequency Counter	>520 MHz	JF 7260A with Option -310
Modulation Analyzer	0.2 to 1000 MHz FM, ØM, AM	HP 8901A with Option -01
Power Meter	0.005 to 1 GHz, SWR <1.1 -20 to +20 dBm*	HP 432A
Power Sensor, Calibrated**	0.005 to 1 GHz, SWR <1.1 -20 to +20 dBm*	HP 478A with Option H75*
Attenuator, 10 dB, Calibrated**	SWR <1.1, 0 to 1.0 GHz Type-N	HP 8491A NARDA 777C-10
10 MHz Frequency Standard	Adequate accuracy for user	
Dual Directional Coupler	0.05 to 1 GHz >35 dB Directivity	NARDA 3020
Low Pass Filter, 1.75 MHz	3 dB Frequency >1 MHz, rejection >40 dB above 5 MHz	Allen Avionics VLF-1P7
Signal Analyzer	Frequency Range >10 kHz, 1 Hz Resolution at 100 Hz	HP 3582A
Oscilloscope	Dual Trace	TEK 475
DC Block, 1000 pf, BNC	50V	
Low Noise Amplifier	10 nV/$\sqrt{Hz}$, >40 dB Gain	TEK AM 502***
DC Operational Amplifier		TEK AM 501***
Feed Thru Termination	50 ohms ±0.1%	JF 442905
Adapter, Type-N to BNC	50 ohm	JF Y9308
Mixer, Double Balanced	BNC, 3 to 1000 MHz	JF Y9313
Attenuator, Fixed	BNC, 6 dB	JF Y9100

Table 1-1. 6070A/6071A List of Required Test Equipment (cont)

ITEM	MINIMUM USE SPECIFICATIONS	RECOMMENDED INSTRUMENT
SWR Test Cable	Approximately 25 feet with <1.6 dB loss at 1 GHz. SWR <1.05 to 1 GHz	JF Y6002
Torque Screwdriver	Torque Range 7 to 9 inch pounds	Jergens H10S CL-6500

*Requires the Calibrated 10 dB Attenuator.

**Both the Power Sensor and the 10 dB Attenuator (if used) must be screened for SWR by the user so that the correct values are known for the tests.

***Require the TEK TM 503 mainframe.

Table 1-2. 6070A/6071A Specifications

Unless otherwise noted, the following performance is guaranteed over the specified environmental an AC line power conditions (see GENERAL at the end of this table), and for normal autoranging operation, 20 minutes after the instrument is turned on.

FREQUENCY

Range
6070A ..... 0.2 to 519.999999 MHz.
6071A ..... 0.2 to 1039.999998 MHz.

Resolution ..... 1 Hz (2 Hz above 520 MHz for the 6071A).

Accuracy and Stability ..... Same as the Reference Oscillator.

Switching Time ..... The time from when the signal at the rear panel OUT VALID connector goes false until the frequency of the RF output signal is within 100 Hz of the final value is less than 70 ms (typically, the IEEE and instrument processing time before the signal at OUT VALID goes false is 10 ms).

Connector ..... Type-N, front panel RF OUTPUT connector. 50 Ohms impedance, nominal.

NOTE: The 607XA-830 Rear RF Output Option makes the RF output signal available at the rear panel instead of at the front panel. Specifications for options are listed near the end of this table.

REFERENCE OSCILLATOR

Internal
TYPE ..... Free-air, 10 MHz crystal oscillator.
AGING RATE ..... < ±0.5 ppm/month
TEMPERATURE STABILITY .... ±5 ppm over the ambient temperature range of 25° C ±25° C (77° F ± 45° F).

NOTE: The 607XA-130 Oven Reference Oscillator Option provides a more stable internal reference. Specifications of options are listed near the end of this table.

External
CONNECTOR ..... BNC rear panel REF IN connector. Input impedance is nominally 50 Ohms, ac coupled.
INPUT SIGNAL ..... The instrument accepts 0.3 to 4.0V peak-to-peak sine or square wave at 1, 2, 2.5, 5, or 10 MHz.
LOCK RANGE ..... ±8 ppm frequency difference. Out-of-lock is indicated by the FREQ and UNCAL annuciators.

Reference Output ..... 10 MHz (TTL) available at the rear panel REF OUT connector (BNC).

AMPLITUDE

Specified Range ..... +19 to -140 below 520 MHz.
+13 to -140 520 MHz and above.

NOTE: AM is restricted above +13 dBm (+7 dBm above 520 MHz) and below -131 dBm.

Unspecified Overrange ..... Up to +20.9 dBm and down to -150 dBm, typically.

Resolution ..... 0.1 dB (at least 1% when displaying voltage).

Table 1-2. 6070A/6071A Specifications (cont)

Switching Time ..... The time from when the signal at the rear panel OUT VALID connector goes false until the amplitude of the RF output signal is within 0.1 dB of the final value is less than 10 ms (typically, the IEEE and instrument processing time before the signal at OUT VALID goes false is 10 ms for voltage and 40 ms for dB programming).

Accuracy and Flatness

RF OUTPUT		ACCURACY (dB)**
FREQUENCY (MHz)	LEVEL (dBm)*	
0.2 to 520 MHz (6070A and 6071A)	+19 to +13	±1.5
	+13 to -131	±[0.8 - 0.01 (output level in dBm)]
	-131 to -140	±4.0
520 to 1040 MHz (6071A only)	+13 to +7	±2.5
	+7 to -131	±[1.6 - 0.015 (output level in dBm)]
	-131 to -140	±4.5

*Subtract 6 dB from the level ranges when AM is on (not specified for <-131 dBm).
**Add ±0.5 dB to the accuracy specification if the 607XA-870 Reverse Power Protection Option is installed.

Source SWR (reference to 50 Ohms) Less than the values listed in the following table.

LEVEL (dBm)	SOURCE SWR	
	0.2 TO 520 MHz	520 TO 1040 MHz
≥+7	2.0	2.5
<+7	1.5	2.0

SPECTRAL PURITY

Spurious ..... Spurs are below the values listed in the following table or -140 dBm, whichever is greater (or -130 dBm at 520 MHz if the 607XA-870 Reverse Power Protection Option is installed).

SPURIOUS SIGNALS	SPECTRAL PURITY (dBc) RF OUTPUT FREQUENCY (MHz)				
	0.2 TO 62.5	62.5 TO 125	125 TO 250	250 TO 520	520 TO 1040
Non-harmonic					
>10 kHz offset*	-90	-100	-96	-90	-84
<10 kHz offset	-70	-82	-76	-70	-64
<0.55 kHz offset	-56	-68	-62	-56	-50
Sub-harmonic (f/2, 3f/2, 5f/2, etc.)	N/A				-35
Harmonic 6070A					
>+13 dBm	-30	-30	-30	-25	N/A
≤+13 dBm	-35	-35	-35	-35	
Harmonic 6071A					
>+13 dBm	-30	-30	-25	-20	N/A
≤+13 dBm	-35	-35	-35	-35	-25

*Spurs are 5 dB worse during HI DEV Mode operation.

Table 1-2. 6070A/6071A Specifications (cont)

Noise Spectral Density ..... The SSB phase noise density is a function of offset and output frequency. The following performance is guaranteed when not in the HI DEV Mode and includes the effect of the internal reference.

FREQUENCY (MHz)	NOISE SPECTRAL DENSITY (dBc/Hz)				
	OFFSET FROM CARRIER				
	0.1 kHz	1 kHz	5 kHz	20 kHz	>3 MHz
0.2 to 62.5	-75	-85	-107	-123	-129
62.5 to 125	-94	-100	-125	-140	-144
125 to 250	-88	-94	-121	-138	-144
250 to 520	-82	-88	-115	-132	-144
520 to 1040	-76	-82	-109	-126	-138

Signal-to-Phase Noise Ratio vs. Offset Frequency from Carrier at 80, 320, and 500 MHz. (Typical)

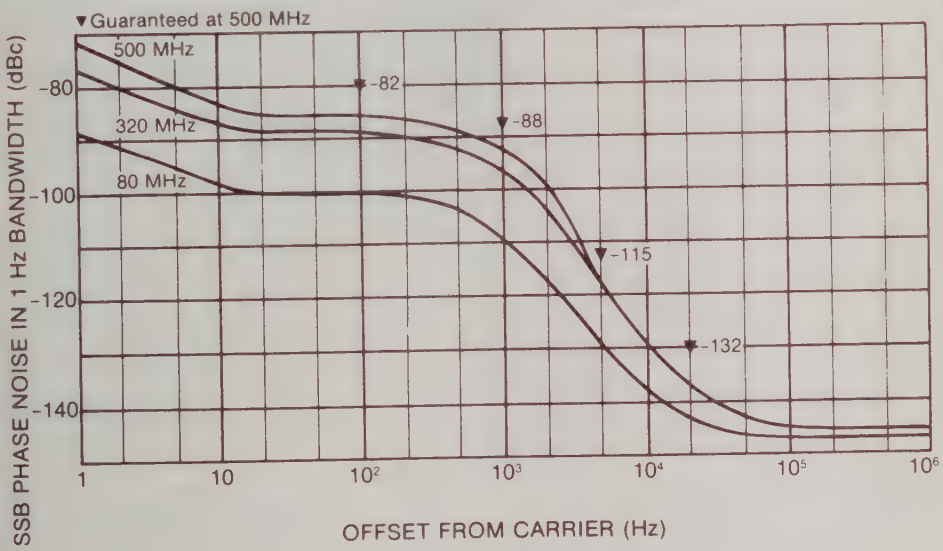
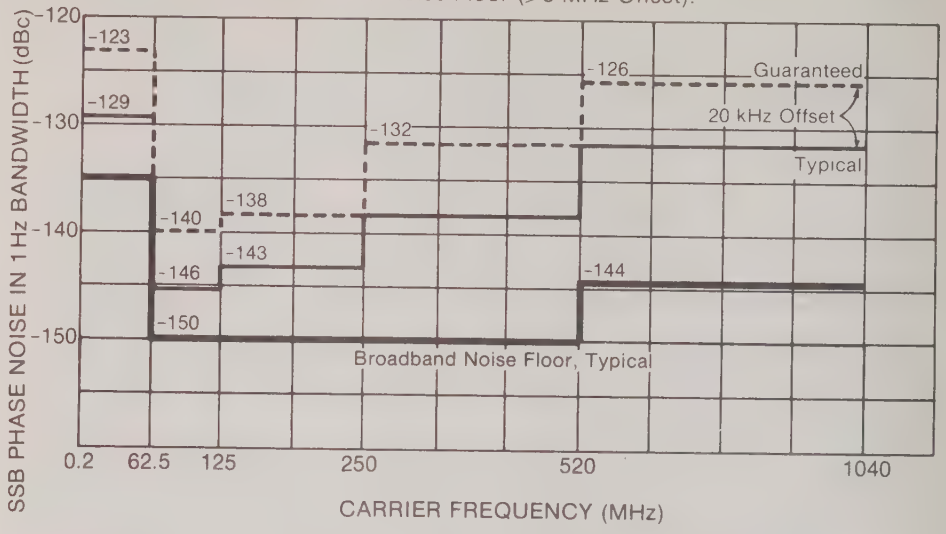
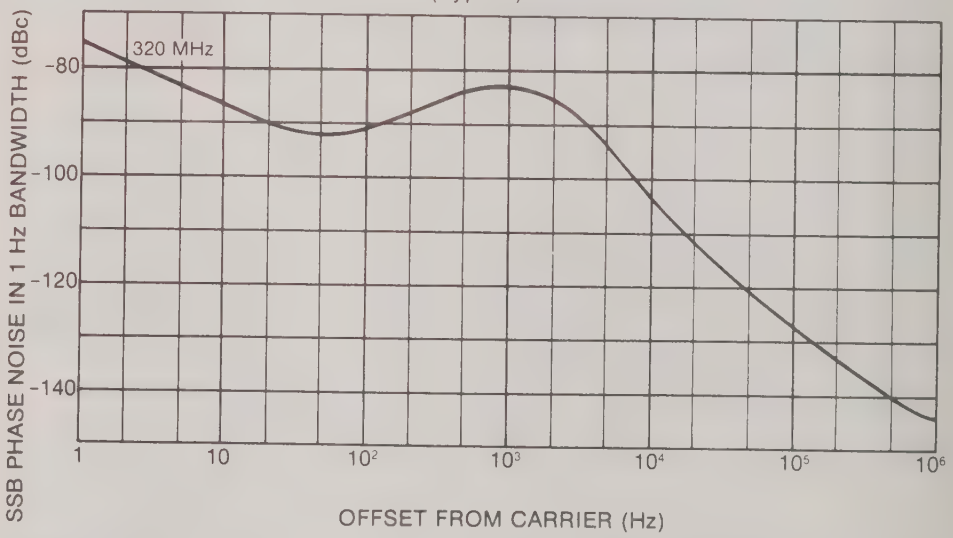


Table 1-2. 6070A/6071A Specifications (cont)

Signal-to-Phase Noise Ratio vs. Carrier Frequency for 20 kHz Offset from Carrier and Broadband Noise Floor (≥3 MHz Offset).



Signal-to-Phase Noise Ratio vs. Offset Frequency from Carrier at 320 MHz in HI DEV Mode (Typical).



Residual FM (Hz rms) ..... The following table lists the residual FM for CW (and low deviation ACFM and 0M).

FREQUENCY (MHz)	RESIDUAL FM (Hz rms)			
	0.3 TO 3 kHz BW		0.05 TO 15 kHz BW	
	HI DEV OFF	HI DEV ON	HI DEV OFF	HI DEV ON
.2 to 62.5	3.5	20	5	35
62.5 to 125	0.5	5	0.75	9
125 to 250	0.85	10	1.3	18
250 to 520	1.7	20	2.5	35
520 to 1040	3.4	40	5	70

Table 1-2. 6070A/6071A Specifications (cont)

Residual AM ..... <0.02% rms in a 50 Hz to 15 kHz post detection bandwidth on all bands.

AMPLITUDE MODULATION

Depth ..... 0 to 99.9% in 0.1% steps where the total output level (amplitude combined with AM) does not exceed +19 dBm peak at RF output frequencies below 520 MHz or exceed +13 dBm peak for RF output frequencies above 520 MHz.

Accuracy ..... ±5% of full scale above 5 MHz or +5% to -8% of full scale below 5 MHz for rates shown in the Distortion specifications that follow. Amplitude accuracy is not specified below -131 dBm.

Distortion (internal or external)

FREQUENCY (MHz)	RATE	DEPTH FOR SPECIFIED ACCURACY	DISTORTION		
			0 TO 30% AM	30 TO 70% AM	70 TO 90% AM
0.2 to 5	≤1 kHz	<90%	<2%	<5%	<7%
5 to 520	≤3 kHz	<90%	<1.5%	<3%	<3%
520 to 1040	≤3 kHz	<70%	<2%	<3%	<5%

Bandwidth, 3 dB ..... at 90% AM for RF output frequencies between 5 MHz and 520 MHz or at 70% AM for RF output frequencies below 5 MHz and above 520 MHz.

FREQUENCY (MHz)	DC COUPLED	AC COUPLED
0.2 to 5	0 to 8 kHz	20 Hz to 8 kHz
5 to 1040	0 to 50 kHz	20 Hz to 50 kHz

Incidental FM ..... <0.3 fm for 30% AM (<0.6 fm above 520 MHz for 6071A), where fm is modulation frequency, at the rates listed in the Distortion specifications.

FREQUENCY MODULATION

Deviation Ranges

FREQUENCY (MHz)	DEVIATION RANGES (kHz)	
	HI DEV MODE OFF	HI DEV MODE ON
0.2 to 62.5	10, 20, 50, 100, 200	50, 100, 200, 500, 1000
62.5 to 125	2, 5, 10, 20, 50	10, 20, 50, 100, 200
125 to 250	5, 10, 20, 50, 100	20, 50, 100, 200, 500
250 to 520	10, 20, 50, 100, 200	50, 100, 200, 500, 1000
520 to 1040	20, 50, 100, 200, 500*	100, 200, 500, 1000

*HI DEV MODE ON if deviation >400 kHz.

Resolution ..... 100 Hz up to 99.9 kHz Dev
1 kHz above 99.9 kHz Dev

Table 1-2. 6070A/6071A Specifications (cont)

Maximum Deviation

FREQUENCY (MHz)	MAXIMUM DEVIATION (kHz)	
	ACFM THE LESSER OF:	DCFM THE LESSER OF:
0.2 to 62.5*	999 or fm(520 - fo)	499 kHz
62.5 to 125	199 or fmfo	fo or 99.9
125 to 250	499 or fmfo	fo or 199
250 to 520	999 or fmfo	fo or 499
520 to 1040	999 or fmfo	fo or 999
Where: fm = the numeric value of modulation frequency expressed in kHz. fo = the numeric value of the RF output frequency in MHz.		

*At low RF output frequencies, the sum of the modulation frequency and the deviation should not exceed 1000(fo - 0.2).

Minimum Deviation ..... 10% of range except for 2, 20, and 200 kHz ranges
12.5% of range for 2, 20, and 200 kHz ranges.

Deviation Accuracy (internal or external, AC or DC)
AT 400 AND 1000 Hz
HI DEV Off ..... ±(10% + 0.125% of range)
HI DEV On ..... ±(7% + 0.125% of range)
FROM 0.3 TO 50 kHz (HI DEV ON OR OFF, DCFM ON OR OFF) .... ±(12% + 0.125% of range)

Distortion ..... The total harmonic distortion on internal or on external sources up to a 50 kHz rate is a function of output frequency and mode, and is less than the values listed in the following table.

FREQUENCY (MHz)	DISTORTION (% THD)	
	HI DEV OFF	HI DEV ON
0.2 to 62.5	0.5 + 0.75/100 kHz DEV	1.5
62.5 to 125	0.5 + 3/100 kHz DEV	1.5
125 to 250	0.5 + 1.5/100 kHz DEV	1.5
250 to 520	0.5 + 0.75/100 kHzDEV	1.5
520 to 1040	0.5 + 0.375/100 kHz DEV	1.5

NOTE: Distortion for the DCFM Mode is 0.5% plus 1.2% per 100 kHz DEV below 62.5 MHz or (600/fo)% per 100 kHz DEV above 62.5 MHz. The specification applies at the ambient temperature at which DCFM is enabled, where fo is the RF output frequency in MHz.

Bandwidth ..... The frequency where the response is 3 dB below the maximum is at least 250 kHz at the high end and less than 20 Hz at the low end when AC coupled.

Incidental AM ..... <0.5% AM for up to 50 kHz deviation at a 1 kHz rate.

Table 1-2. 6070A/6071A Specifications (cont)

Center Frequency Accuracy ..... Same as the reference oscillator for ACFM. The center frequency accuracy values are listed in the following table for the DCFM Mode (after enabling DCFM).

FREQUENCY (MHz)	MAXIMUM INITIAL OFFSET (Hz)	TYPICAL FREQUENCY STABILITY (Hz/MINUTE)
0.2 to 62.5	±1000	50
62.5 to 125	±250	12.5
125 to 250	±500	25
250 to 520	±1000	50
520 to 1040	±2000	100

PHASE MODULATION

Index Ranges

FREQUENCY (MHz)	INDEX RANGES (RADIANS)	
	HI DEV OFF	HI DEV ON
0.2 to 62.5	1, 2, 5, 10, 20	5, 10, 20, 50, 100
62.5 to 125	0.2, 0.5, 1, 2, 5	1, 2, 5, 10, 20
125 to 250	0.5, 1, 2, 5, 10	2, 5, 10, 20, 50
250 to 520	1, 2, 5, 10, 20	5, 10, 20, 50, 100
520 to 1040	2, 5, 10, 20, 50*	10, 20, 50, 100

*HI DEV Mode if index > 40 Radians.

Resolution ..... 0.01 radian up to 9.99 radian.
0.1 radian above 99.9 radian.

Maximum Index ..... Same as the highest available range.

Minimum Index ..... 10% of range except for 0.2, 2, and 20 radian ranges
12.5% of range for 0.2, 2, and 20 radian ranges.

Index Accuracy (internal or external)
AT 400 AND 1000 Hz
HI DEV Off ..... ±(10% + 0.125% of range)
HI DEV On ..... ±(7% + 0.125% of range)
FROM 0.3 TO 3 kHz (HI DEV ON OR OFF) ..... ±(12% + 0.125% of range)

Distortion ..... The total harmonic distortion is less than the values in the following table.

FREQUENCY (MHz)	HI DEV OFF	HI DEV ON
0.2 to 62.5	0.5% + (0.75 x 10^{-5}fm)% per Rad	1.5%
62.5 to 125	0.5% + (3.0 x 10^{-5}fm)% per Rad	1.5%
125 to 250	0.5% + (1.5 x 10^{-5}fm)% per Rad	1.5%
250 to 520	0.5% + (0.75 x 10^{-5}fm)% per Rad	1.5%
520 to 1040	0.5% + (0.37 x 10^{-5}fm)% per Rad	1.5%

Where fm is the numerical value of the modulation frequency in Hz.

Table 1-2. 6070A/6071A Specifications (cont)

Bandwidth	The frequency where the response is 3 dB below the maximum is at least 12 kHz at the high end and less than 20 Hz (ac coupled) or dc (dc coupled) at the low end.
Incidental AM	<0.5% AM for deviations up to 50 radians at 1 kHz rate
EXTERNAL MODULATION INPUT	
Connector	Front and rear panel MOD IN connectors (BNC), connected in parallel, with a nominal 600 Ohm input impedance.
External Input Sensitivity	1V peak provides the programmed modulation depth.
INTERNAL MODULATION OSCILLATOR	
Frequency Ranges	20 Hz to 199 Hz 200 Hz to 1,990 kHz 2 kHz to 19.9 kHz 20 kHz to 199 kHz
Unspecified Overrange	Down to 1 Hz and up to 255 kHz.
Frequency Accuracy	±3% over the range 20 to 30°C (68 to 86°F). ±(3% + 0.1%/°C)below 20 and above 30°C.
Distortion	<0.15% THD from 0.2 to 100 kHz <0.2% THD below 0.2 kHz and above 100 kHz.
Output	Front panel MOD OUT connector (BNC) and associated level control provide nominally 0 to 1 volt peak into 600 Ohms. Level is not programmable. Output impedance is 600 Ohms, nominal.
OTHER OUTPUTS	
Sweep Analog Output	Front panel SWP OUT connector (BNC) provides 0 to 10V up to a 1000 point stepped ramp. Accuracy of the output is ±5% of output ±0.1V.
Penlift	Rear panel PEN LIFT connector (BNC) provides a TTL signal which is high during sweep retrace and until the next sweep starts.
Output Valid	Rear panel OUT VALID connector (BNC) provides a TTL signal which is low when the RF output is potentially unsettled. This signal is also available on the IEEE interface.

Table 1-2. 6070A/6071A Specifications (cont)

MEMORY

Memory Functions	Store, recall, insert above, delete, define top.
Number of Locations	9 standard, volatile (contents are lost when power is removed); 50 with the 607XAA-570 Non-Volatile Memory Option (contents are retained for about 4 years after power is removed). Front panel setups can be stored in each location and later recalled.

FREQUENCY SWEEP

Sweep Modes	Auto, (repetitive), single, manual.
Sweep Functions	Symmetrical sweep, asummetrical sweep, sweep speed.
Data Entry Parameters	Sweep width and sweep increment.
Sweep Speed	When slow sweep speed is not selected, the instrument will sweep frequency as fast as possible without regard to whether or not the frequency is settled. When slow sweep speed is selected, the settled period of each increment can be set to 20 ms, 50 ms, 100 ms, 200 ms, and 500 ms.
Sweep Output	0 to +10V, up to 1000-point stepped ramp. Available at the front panel SWP OUT connector.
Penlift/Z Axis Blanking Output	TTL level at the rear panel PEN LIFT connector. High during sweep retrace and until the next sweep starts.

REMOTE CONTROL

Interface	IEEE Standard 488, 1978.
Functions Controlled	All front panel controls except the POWER and MOD OUT controls.
Status Indicators	REM (remote), ADDR (addressed), SRQ.
Interface Functions	SH1, AH1, T6, TE0, L3, LE0, SR1, RL1, PP0, DC1, DT1, C0.

GENERAL

Temperature	
OPERATING	0 to 50°C (32 to 122°F)
NON-OPERATING	-40 to 75°C (-40 to 167°F)
Operating Humidity	0 to 95% up to 25°C (77°F) 0 to 75% up to 50°C (122°F)

Table 1-2. 6070A/6071A Specifications (cont)

Conducted and Radiated Interference	<3 uV induced in a 2 turn, 1-inch loop that is 1 inch from any surface and measured into a 50 Ohms receiver. Complies with RE02 and CE03 of MIL-STD-461A, sections 4.3.1 and 4.3.2 of MIL-I-6181D, both narrow and broad band.
Size	width: 43 cm / 17 inches; height: 13.3 cm / 5.25 inches; depth: 54.6 cm / 21.5 inches
Weight	28 kg (61 lbs.)
Power	100, 120, 200, and 240V ac ±10%, 47 to 63 Hz.
Protection Class	Class 1 (as defined in IEC 348)

OPTIONS

607XA-130 Oven Reference Option

FREQUENCY	10 MHz
AGING RATE	$<\pm 5 \times 10^{-10}$/day, after a 21 day warmup.
TEMPERATURE STABILITY	$<\pm 2 \times 10^{-10}$/°C.
POWER	On during standby operation (STBY indicator on).

607XA-570 Non-Volatile Memory Option

NUMBER OF LOCATIONS	50
STORAGE TIME	With power removed, the contents will be retained for about 4 years.
POWER SOURCE	Instrument power supply, operating or in standby. Battery when power is removed.
POWER-ON CONDITION	Instruments with this option return the front panel to the setup that existed when the instrument was placed in standby or was turned off.

607XA-830 Rear RF Output Option
(replaces the front panel RF OUTPUT connector)

SPECIFICATIONS	Same as standard instrument.
CONNECTOR	Type N, rear panel RF OUT connector.

607XA-831 Auxiliary RF Output Option

FREQUENCY	Same as RF output frequency.
AMPLITUDE	>–18 dBm for normal autoranging operation.
IMPEDANCE	50 Ohms, nominal.
CONNECTOR	BNC, rear panel AUX OUT connector.

Table 1-2. 6070A/6071A Specifications (cont)

607XA-870 Reverse Power Protection Option

PROTECTION LEVEL	Up to 50 watts from a 50 Ohm source over the frequency range of 0.2 to 1040 MHz. Will withstand up to 50V dc (dc blocking capacitor at the output).
LEVEL ACCURACY	Add ±0.5 dB to Amplitude Accuracy (listed earlier in this table).
HARMONICS	Degrade harmonics specifications (listed earlier in this table) by 5 dB for levels above +13 dBm.

Section 2
Shipping and Service Information

2-1. SHIPPING INFORMATION

2-2. The instrument is packaged and shipped in foam-packed container. When you receive the instrument, inspect it thoroughly for possible shipping damage. Special instructions for inspection claims are included in the shipping container.

2-3. If reshipment is necessary, use the original shipping container. If the original container is not available, order a new one from the John Fluke Mfg. Co., Inc., P.O. Box 43210; Mountlake Terrace, WA 98043; telephone (206) 774-2211. When ordering a new shipping container, state the instrument model number.

2-4. SERVICE INFORMATION

2-5. Warranty

2-6. Each John Fluke Model 6070A and 6071A Synthesized RF Signal Generator is warranted for a period of one year delivery to the original purchaser. The WARRANTY is located at the front of the 6070A/6071A Operator Manual.

2-7. Service

2-8. Factory authorized service (including calibration) for either the 6070A or the 6071A is available at selected John Fluke Technical Service Centers. For service and/or calibration, return your instrument to the nearest John Fluke Techanial Service Center. The local technical service center will handle transportation to and from the selected technical service centers as required. Tables A-1 and A-2 in Appendix A provide a complete list of John Fluke Technical Service Centers. Appendix A is located at the rear of this manual. If requested, you will be provided with an estimate before work is begun on instruments that are beyond the warranty period.

2-9. ADDITIONAL INFORMATION

2-10. For any additional information, contact your nearest John Fluke Sales Representative or the John Fluke Mfg. Co., Inc.; P.O. Box 43210, Mountlake Terrace, WA 98043; telephone (206) 774-2211. Tables A-3 and A-4 in Appendix A provide a complete list of the John Fluke Sales Representatives. Appendix A is located at the rear of this manual.

Section 3
Access Procedures

3-1. INTRODUCTION

3-2. The information in this section describes instrument access procedures. Each access procedure is composed of a disassembly procedure and the corresponding assembly procedure. The disassembly procedures allow access to only the Auxiliary Power Supply Fuse and the test points adjustments described in Sections 6 and 7C. The assembly procedures describe how to put the instrument back together. The figures that illustrate these procedures are located at the end of this section. The 6070A/6071A Service Manual contains procedures that provide access to every replaceable component in the instrument.

3-3. INTERIOR ACCESS PROCEDURE

3-4. Introduction

3-5. The Interior Access Procedure allows access to the interior of the instrument. This procedure is basic to every other access procedure. Since the following disassembly and assembly procedures are simple, they are not illustrated.

3-6. Disassembly Procedure

3-7. Remove the top and bottom covers to gain access to the interior of the instrument. Use the following procedures:

1. Remove the five screws along the front edge and the five screws along the rear edge of each cover.

2. Lift the covers off of the instrument.

3-8. Assembly Procedure

3-9. Assemble the instrument by installing the top and bottom covers using the following procedure:

1. Slide the covers back onto the instrument. Make sure that the cover slots are toward the front of the instrument. Make sure that the edge of each cover side fits onto the slots in the side rails of the instrument.

2. Fasten the covers in place using the screws removed during the disassembly procedure.

3-10. A3A3 DELAY DISCRIMINATOR PCB ACCESS PROCEDURE

3-11. Introduction

3-12. The A3A3 Delay Discriminator PCB Access Procedure allows access to the test points and adjustments described in Section 6. After the module cover has been removed, the cover screws must be torqued back in place to insure specified RF integrity. Figure 3-1 illustrates the sequence in which the screws must be torqued.

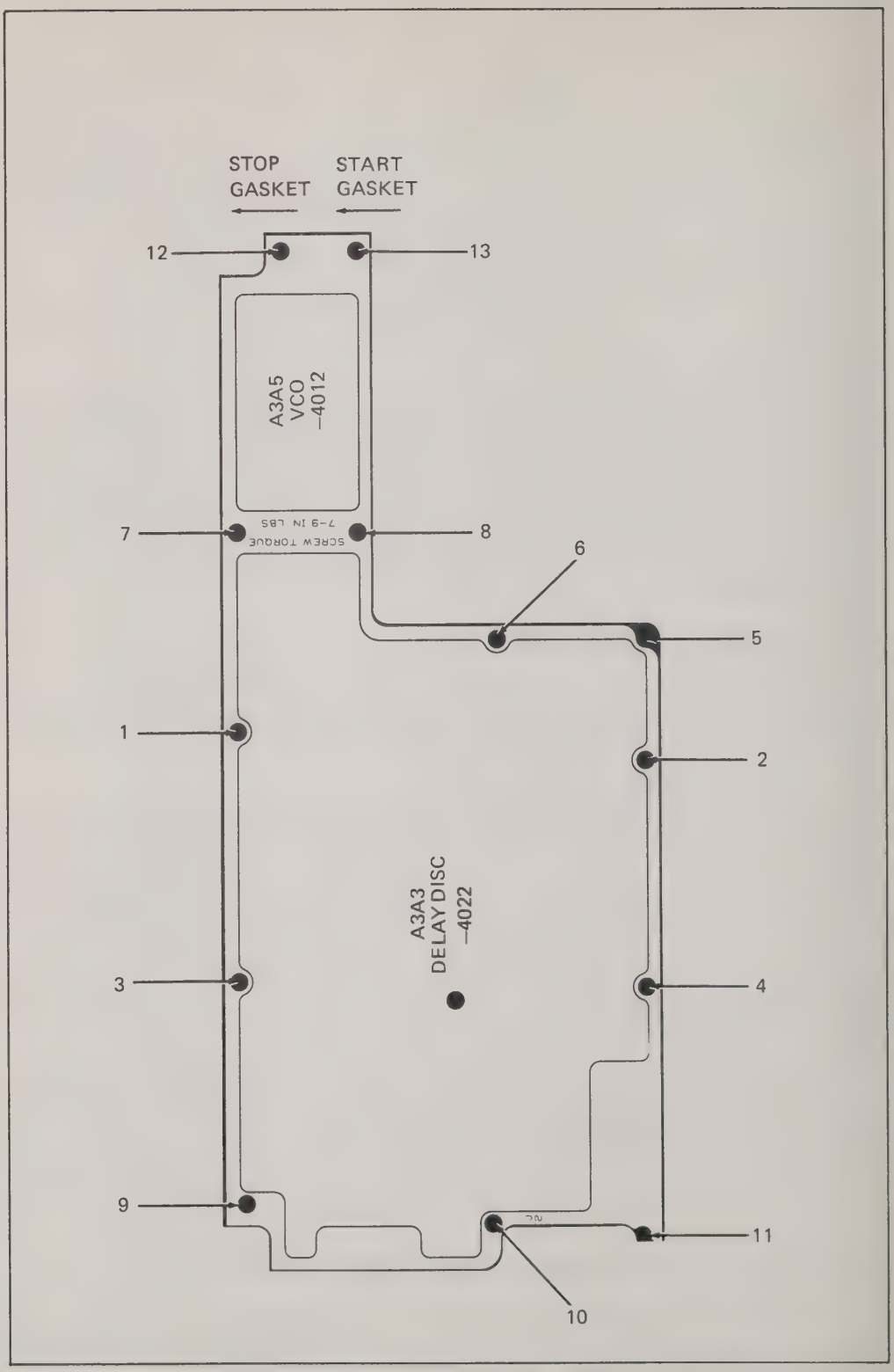


Figure 3-1. A3A3 Delay Discriminator/A3A5 VCO Cover

3-13. Disassembly Procedure

3-14. Complete the following procedure to gain access to the A3A3 Delay Discriminator PCB test points and adjustments described in Section 6.

1. Set the front panel POWER control and the rear panel MAIN POWER switch to the OFF positions and remove line power from the instrument.

2. Complete the disassembly portion of the Interior Access Procedure.

3. Remove the thirteen screws and flat washers that hold the A3A3 Delay Discriminator/A3A5 VCO cover in place.

4. Carefully lift the cover off; do not distrub the RF gaskets under the cover.

3-15. Assembly Procedure

3-16. Complete the following procedure to assemble the instrument:

1. Make sure that the RF gasket is in place. The gasket should start and end halfway between screws number 1 and number 8 (Figure 3-1). Inspect the RF gaskets for damage (areas that are folded over, worn, or pinched).

2. If the RF gasket falls out, use the following steps to properly install it:

   a. Start the RF gasket at screw number 13 (Figure 3-1).

   b. Traveling counterclockwise, press the gasket into the groove.

   c. The end of the gasket should continue past the beginning of the gasket (at screw 13) to screw 12 (Figure 3-1).

3. Lower the cover carefully and start the 13 screws through the washers. Do not tighten any of the screws.

4. Use the Torque Screwdriver to tighten all the screws. Use the following procedure:

   a. Torque all the screws to 3 inch-pounds in the numerical sequence shown in Figure 3-1.

   b. Torque all the screws to 7 to 9 inch-pounds in the numerical sequence shown in Figure 3-1. The torque value should be the same for all screws.

3-17. A3A1 PHASE DETECTOR PCB ACCESS PROCEDURE

CAUTION

To prevent damage to the coaxial cables and connectors, observe the cautions when handling the cables or connectors:

1. Do not bend the cables.

2. Do not place excessive strain between the cables and the connectors.

3. Start SMA connectors carefully - keep the connector straight with respect to the jack.

3-18. Introduction

3-19. The A3A1 Phase Detector PCB Access Procedure allows access to the test points and adjustments discussed in Section 6. After the module cover has been removed, the cover screws must be torqued back in place to insure specified RF integrity. Figures 3-2, 3-3, 3-4, and 3-5 illustrate the disassembly and assembly procedures.

3-20. Disassembly Procedure

3-21. Complete the following procedure to gain access to the A3A1 Phase Detector PCB test points and adjustments described in Section 6:

1. Set the front panel POWER control and the rear panel MAIN POWER switch to the OFF positions and remove line power from the instrument.

2. Complete the disassembly portion of the Interior Accews Procedure.

3. Swing the Synthesizer Module out using the following procedure:

   a. Refer to Figure 3-2 and disconnect J3, J5, J6, J7, J8, J9, J10.

   b. Remove the four screws and washers (H1 and H2) and the two screws (H3) shown in Figure 3-3.

   c. Swing the Synthesizer Module out 90o and lock it in this position by fastening the two screws (H3) in positions B.

4. Remove the 19 screws and washers that hold the lower cover of the Synthesizer Module in place (Figure 3-5).

5. Carefully remove the cover so that the RF gaskets under the cover are not disturbed.

6. If the instrument is to be operated (as in the procedures described in Section 6), jumper cables from the 6070A/6071A Service Kit must be installed between some of the connectors and the connections that have been disconnected.

3-22. Assembly Procedure

3-23. Complete the following procedure to assemble the instrument.

1. Make sure that the RF gaskets are in place (Figure 3-4) and inspect that RF gaskets for damage (areas that are folded over, worn, or pinched).

2. If any RF gaskets falls out, use the following steps to properly install it:

   a. Start the RF gasket at the appropriate START GASKET point shown in Figure 3-4.

   b. Traveling in the direction indicated, press the gasket into the groove.

   c. The end of the gasket should be at the TERMINATE GASKET point shown in the Figure 3-4.

3. Lower the cover carefully and start the 19 screws through the washers. Do not tighten any of the screws.

4. Use Torque Screwdriver to tighten all the screws. Use the following procedure:

   a. Torque all the screws to 3 inch-pounds in the numerical sequence shown in Figure 3-5.

   b. Torque all the screws to 7 to 9 inch-pounds in the numerical sequence shown in Figure 3-5. The torque value should be the same for all screws.

5. Swing the Synthesizer Module back into place using the following procedure:

   a. Remove any jumper cables that may have been installed.

   b. Remove the two screws (H3) from the Position B holes.

CAUTION

To avoid cable damage when swinging the synthesizer module back in place, make sure that the cables between the synthesizer plate and thedelay line are in the positions shown in Figure 3-6.

   c. Swing the Synthesizer Module completely into position; make sure that the semi-rigid coaxial cables between the Synthesizer Module and the Delay Line are in the Positions shown in Figure 3-6. This insures that these cables are not damaged by one of the screws in the Synthesizer Module cover or by cables being crossed over one another.

   d. Fasten the two screws (H3) into Position A (Figure 3-2) and fasten the four washers and screws (H1 and H2) back in place.

   e. Refer to Figure 3-2 and connect J3, J5, J6, J7, J8, J9, J10.

6. Complete the assembly portion of the Interior Access Procedure.

3-24. POWER SUPPLY ACCESS PROCEDURE

WARNING

LETHAL VOLTAGES ARE EXPOSED WHEN THE POWER SUPPLY IS DISASSEMBLED. REMOVE LINE POWER BEFORE STARTING DISASSEMBLY AND OBSERVE ALL APPLICABLE SAFETY PRECAUTIONS IF LINE POWER IS RECONNECTED TO THE INSTRUMENT BEFORE THE POWER SUPPLY IS ASSEMBLED.

3-25. Introduction

3-26. The following procedures provide access to all power supply test points and adjustments and to the Auxiliary Power Supply Fuse. Figures 3-2 illustrates the disassembly and assembly procedures.

3-27. Disassembly Procedure

3-28. Use the following procedure to access the Auxiliary Power Supply Fuse (F2) and the power supply test points and adjustments described in Section 6.

1. Set the front panel POWER control and the rear panel MAIN POWER switch to the OFF positions and remove line power from the instrument.

2. Complete the disassembly portion of the Interior Access Procedure.

3. Remove the washers and locking nuts (H4 and H5) from the BNC and Type-N connectors at the left side (facing from the rear of the instrument) of the rear panel (Figure 3-2).

4. On the A6A6 Series Pass Motherboard PCB (immediately in front of the fan), disconnect P4, P5, P6, and P7 (Figure 3-3).

5. Under the A6A6 Series Pass Motherboard PCB, remove the folded portion of the IEEE cable from the retaining strap (Figure 3-3).

6. Remove the 12 screws (H6) that connect the Rear Panel Assembly to the instrument.

7. If the 607XA-130 Oven Reference Option is not installed, go to Step 8. If the 607XA-130 Oven Reference Option is installed, remove the right rear handle (facing from the front of the instrument) before going to Step 8. Use the following procedure:

a. Remove the decal from the base of the right rear handle.

b. Remove the five screws that connect the right rear handle to the instrument and remove the handle.

8. Pull the Rear Panel Assembly from the instrument and replace the right rear handle.

9. Rotate the Rear Panel Assembly so that it rests upon the back of the handles.

10. Remove the six screws (H7) that hold the power supply cover in place.

11. Slide the power supply cover off of the power supply. All power supply adjustments and test points described in Section 6 are now accessed.

12. The Auxiliary Power Supply Fuse (F2) is located on the bottom of the power supply on the A5A2 Power Supply Regulator PCB Assembly.

3-29. Assembly Procedure

3-30. Complete the following steps to assemble the instrument:

1. Make sure that the front panel POWER control is in the STBY position, that the rear panel MAIN POWER switch is in the OFF position, and that the instrument is disconnected from line power.

2. Slide the power supply cover in place and secure it using the six screws (H7).

3. If the 607XA-130 Oven Reference Option is installed, remove the right rear handle.

4. Slide the Rear Panel Assembly partially back into place. Be careful to insert all of the BNC and Type-N connectors through the appropriate holes in the Rear Panel Assembly.

5. Plug J4, J5, J6, and J7 into the appropriate connectors.

6. Fold the IEEE cable and insert the fold under the retaining strap.

7. Slide the Rear Panel Assembly completely into place and secure it using the 12 screws (H6).

8. Fasten the BNC and Type-N connectors to the rear panel using the washers and lock-nuts (H6 and H5).

9. If the 607XA-130 Oven Reference Option is not installed, go to Step 8. If the 607XA-130 Oven Reference Option is installed, connect the right rear handle before going to Step 9. Use the following procedure:

   a. Place the handle in position and tighten the five screws.

   b. Glue the decal back in place at the base of the handle.

10. Complete the assembly portion of the Interior Access Procdure.

3-31. A4A6/A4A7 (X2) OUTPUT AMPLIFIER PCB ACCESS PROCEDURE

3-32. Introduction

3-33. The A4A6/A4A7 (X2) Output Amplifier PCB Access Procedure allows the technician access to the test points and adjustments described in Section 6. The A4A7 Output Amplifier PCB is used in the Model 6070A instruments. The A4A6 X2 Output Amplifier PCB is used in Model 6071A instruments. Both pcbs are physically located in the same place and have the same access procedure. After the module cover has been removed, the cover screws must be tightened to a specified torque value to insure RF integrity.

3-34. Disassembly Procedure

3-35. Complete the following procedure to access the output amplifier pcb test points and adjustments described in Section 6:

1. Set the front panel POWER control to STBY. Set the rear panel MAIN POWER switch to OFF. Disconnect the instrument from line power.

2. Complete the disassembly portion of the Interior Access Procedure.

3. Remove the screws and washers that hold that bottom cover of the output module (Figure 3-8) in place.

4. Carefully lift the cover off; do not disturb the RF gaskets under the cover.

3-36. Assembly Procedure

3-37. Complete the following procedure to assemble the instrument:

1. Make sure the RF gaskets are in place (Figure 3-7) and inspect the RF gaskets for damage (areas that are folded over, worn, or pinched).

2. If one of the gaskets falls out, use the following steps to properly install it:

   a. Start the gasket at the appropriate START GASKET point shown in Figure 3-7.

   b. Traveling in the direction indicated, press the gasket into the groove.

   c. The end of the gasket should be at the TERMINATE GASKET point shown in Figure 3-7.

3. Lower the cover carefully in place and start all the screws through the washers. Don't tighten any of the screws.

4. Use the Electric Torque Screwdriver to tighten all the screws according to the following procedure:

a. Torque all screws to 3 inch-pounds in the numerical sequence shown in the Figure 3-8.

b. Torque all screws to 7 to 9 inch-pounds in the numerical sequence shown in Figure 3-8. The torque value should be the same for all screws.

5. Complete the assembly portion of the Interior Access Procedure.

3-38. A4A5 R.P.P. PCB ACCESS PROCEDURE

CAUTION

To prevent damage to the coaxial cables and connectors, observe the following cautions when handling the cables and connectors.

1. Do not bend the cables.

2. Do not place excessive strain between the cables and the connectors.

3. Start SMA connectors carefully - keep the connector straight with respect to the jack.

3-39. Introduction

3-40. The A4A5 R.P.P. PCB Access Procedure allows access to the adjustments described in Section 7C. Figures 3-2, 3-3, 3-9, and 3-10 illustrate the procedure.

3-41. Disassembly Procedure

3-42. Complete the following procedure to access the A4A4 R.P.P. adjustment described in Section 7C.

1. Set the front panel POWER control to STBY. Set the rear panel MAIN POWER control to OFF. Remove line power from the instrument.

2. Complete the disassembly portion of the Interior Access Procedure.

3. Complete the following steps to swing out the Output Module:

a. Refer to Figure 3-2 and disconnect J1, J4, J5, J13, andJ14.

b. Remove the four screws and washers (H1 and H2) and the two screws (H3) shown in Figure 3-3.

c. Lift the Output Module until J10, J11, and J12 can be reached. Disconnect J10, J11, and J12.

d. Swing the module out 90° and lock it in this position by installing the two screws (H3) in positions B. Remove the R.P.P. cover screws.

5. Carefully lift the cover off; do not disturb the RF gasket under the cover.

6. If the instrument is to be operated (as in the procedures described in Section 7C), jumper cables from the 6070A/6071A Service Kit must be installed. For the procedures in Section 7C, install two jumper cables: one from A4AJ5 to A3AJ5 and one from A4A13 to A3AJ10.

3-43. Assembly Procedure

3-44. Complete the following procedure to assemble the instrument:

1. Remove the jumper cables that have been installed.

2. Make sure the RF gaskets are in place (Figure 3-9) and inspect the RF gaskets for damage (areas that are folded over, worn, or pinched).

3. If the RF gaskets falls out, use the following steps to properly install it:

   a. Start the gasket at the START GASKET point shown in Figure 3-9.

   b. Traveling in the direction indicated, press the gasket into the groove.

   c. The end of the gasket should be at the TERMINATE GASKET point shown in Figure 3-9.

4. Lower the cover carefully in place and start all the screws through the washers. Don't tighten any of the screws.

5. Use the Electric Torque Screwdriver to tighten all the screws according to the following procedure:

   a. Torque all screws to 3 inch-pounds in the numerical sequence in Figure 3-10.

   b. Torque all screws to 7 to 9 inch-pounds in the numerical sequence shown in Figure 3-10. The torque value should be the same for all screws.

6. Swing the Output Module back into place using the following procedures:

   a. Remove the two screws (H3) from Positions B.

   b. Swing the Output Module toward the instrument until J10, J11, and J12 can be connected. Connect J10, J11, and J12.

   c. Swing the Output Module completely back into position.

   d. Fasten the two screws (H3) into Position A (Figure 3-2) and fasten the four washers and screws (H1 and H2) back in place.

   e. Refer to Figure 3-2 and connect J1, J4, J5, J13, and J14.

7. Complete the assembly portion of the Interior Access Procedure.

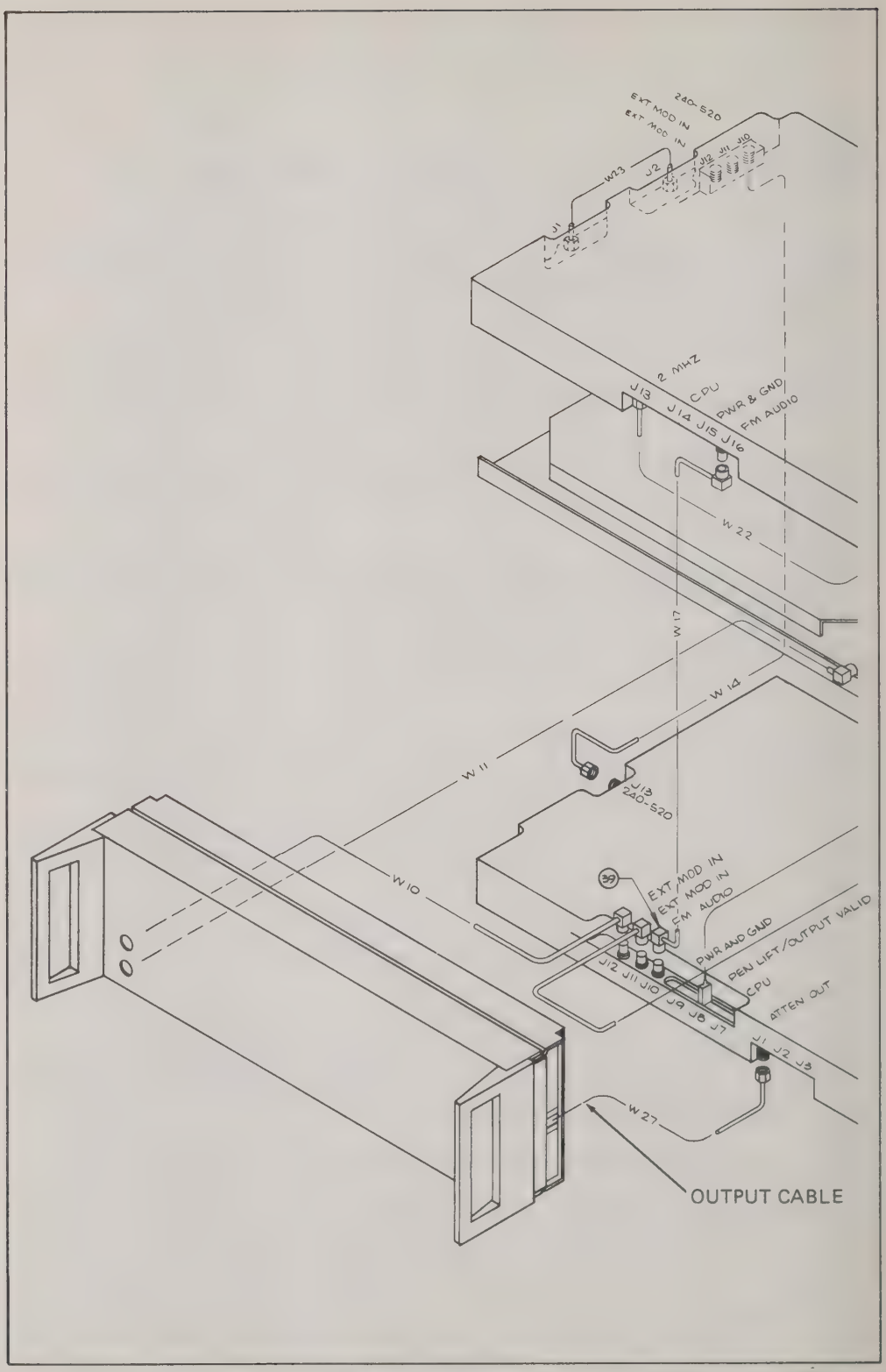


Figure 3-2. Access I

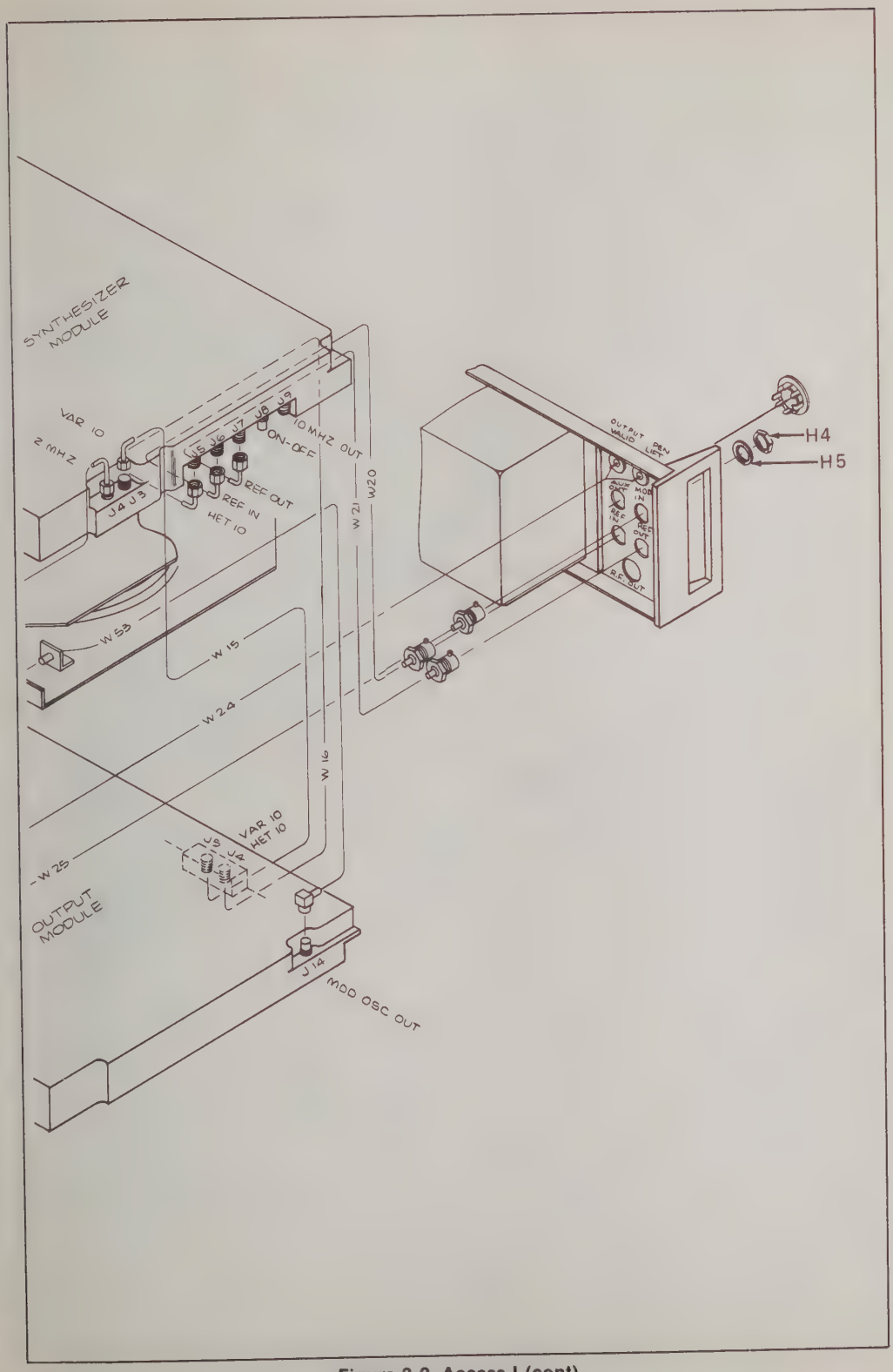


Figure 3-2. Access I (cont)

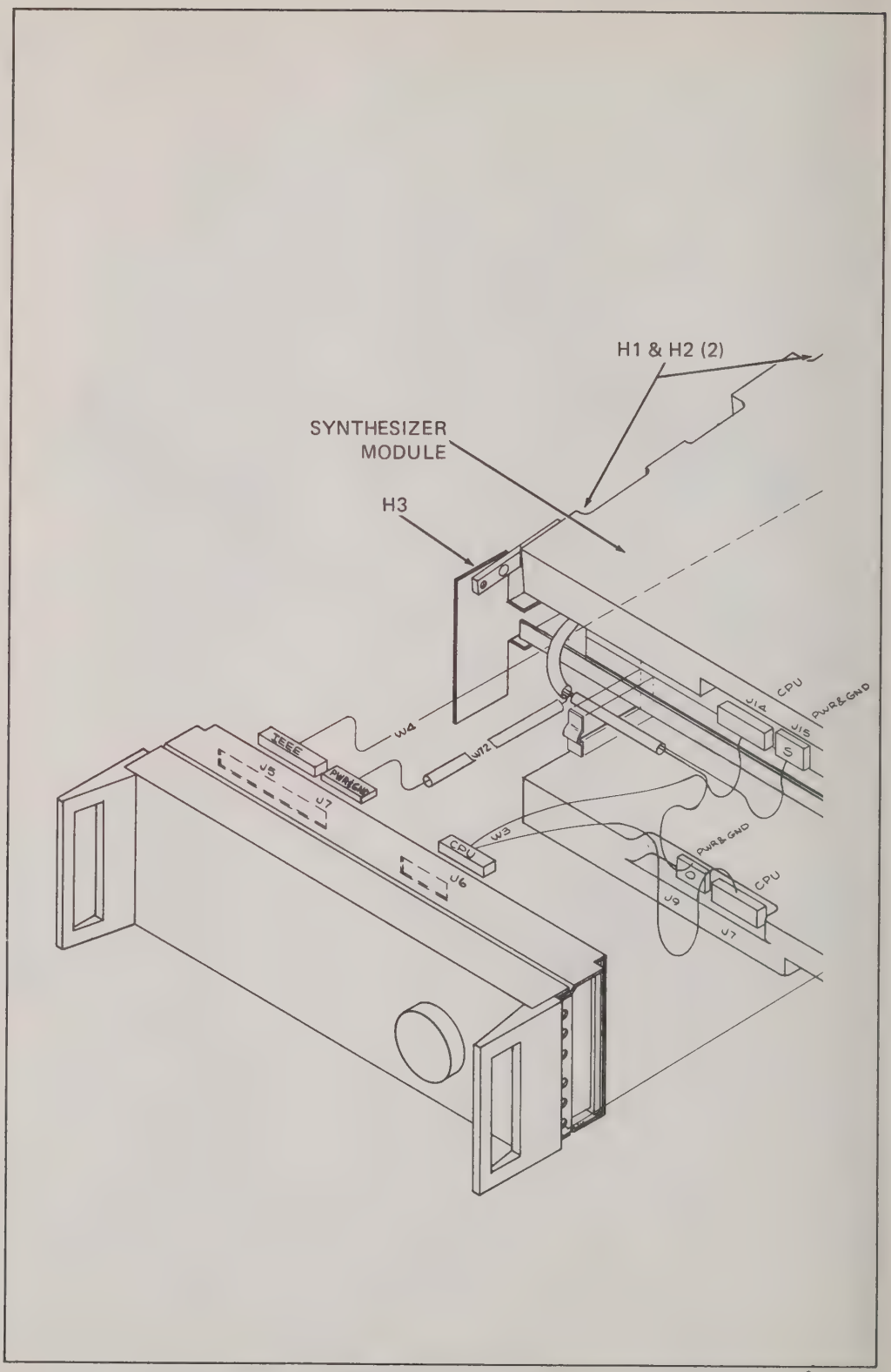


Figure 3-3. Access II

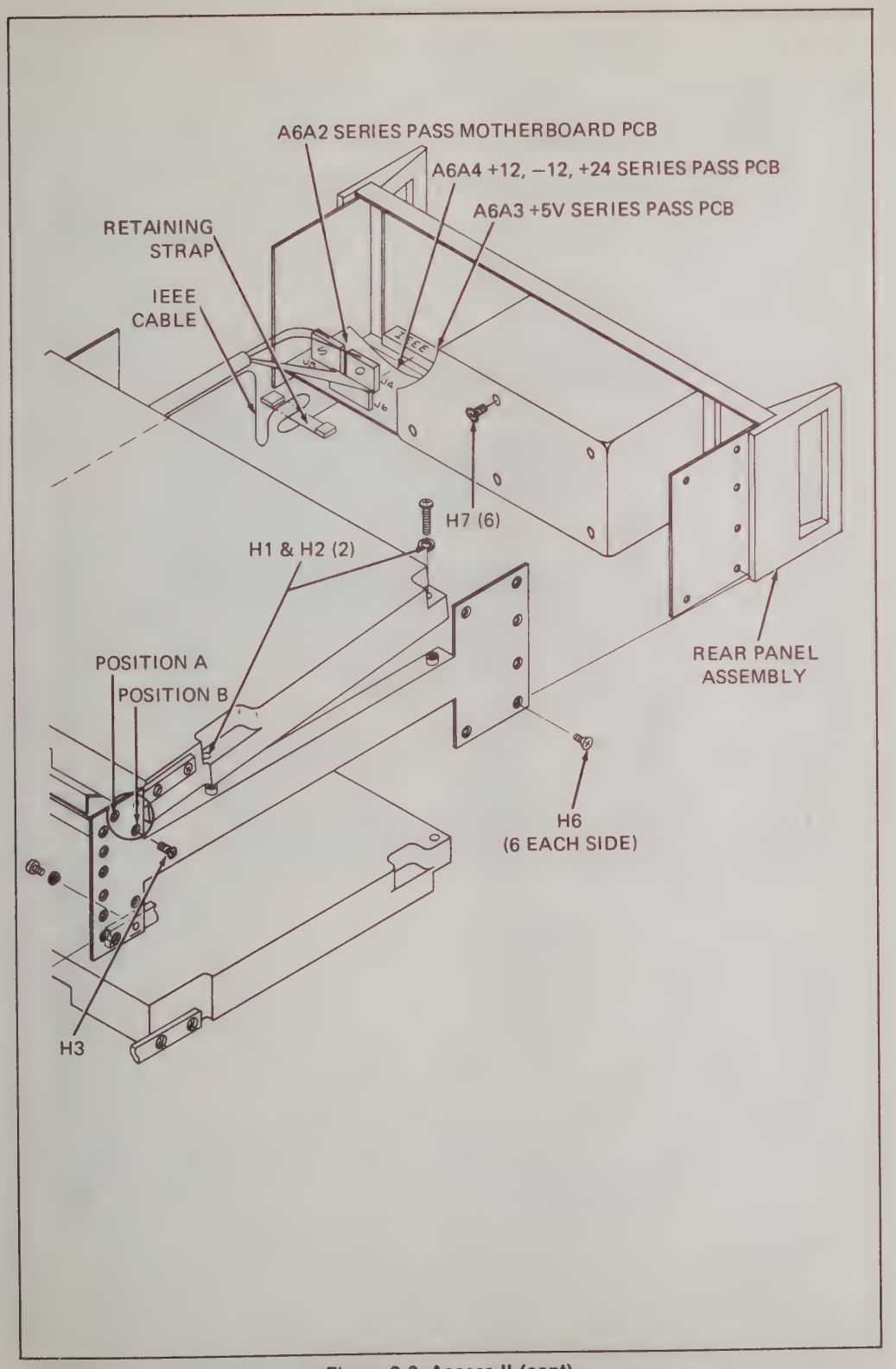


Figure 3-3. Access II (cont)

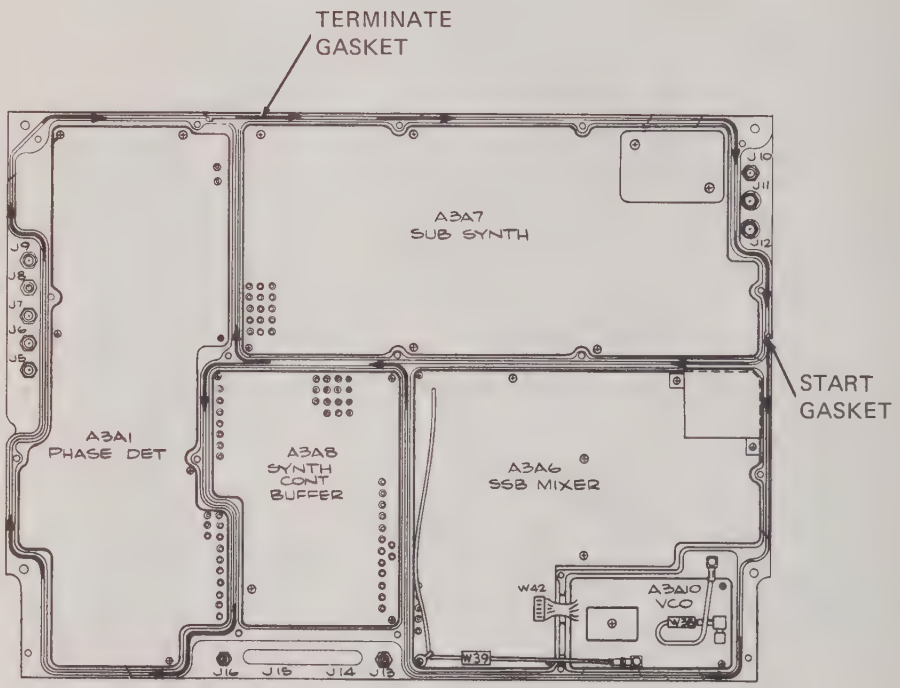


Figure 3-4. RF Gasket Positions - Bottom of Synthesizer Module

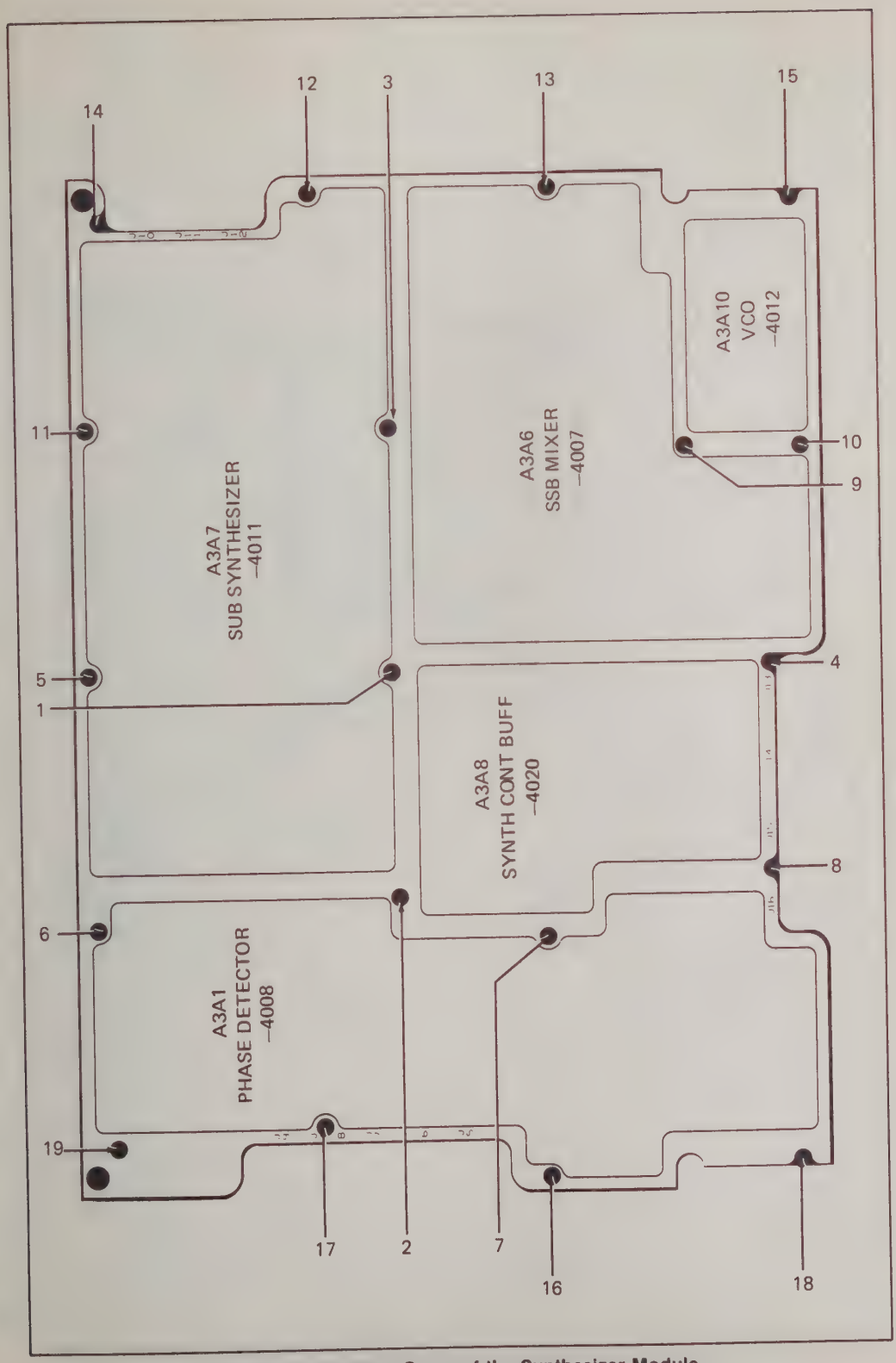


Figure 3-5. Bottom Cover of the Synthesizer Module

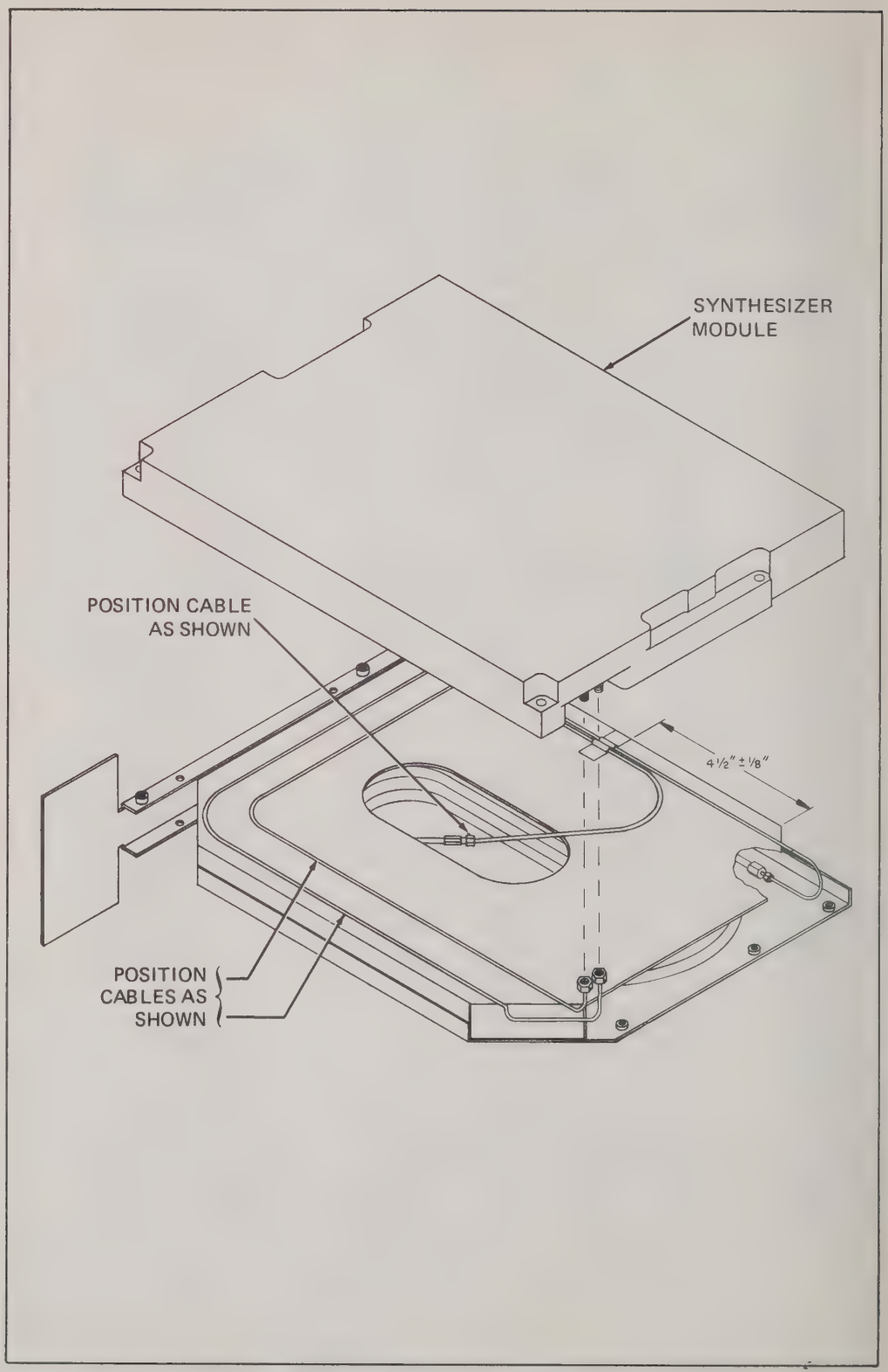


Figure 3-6. Cable Locations

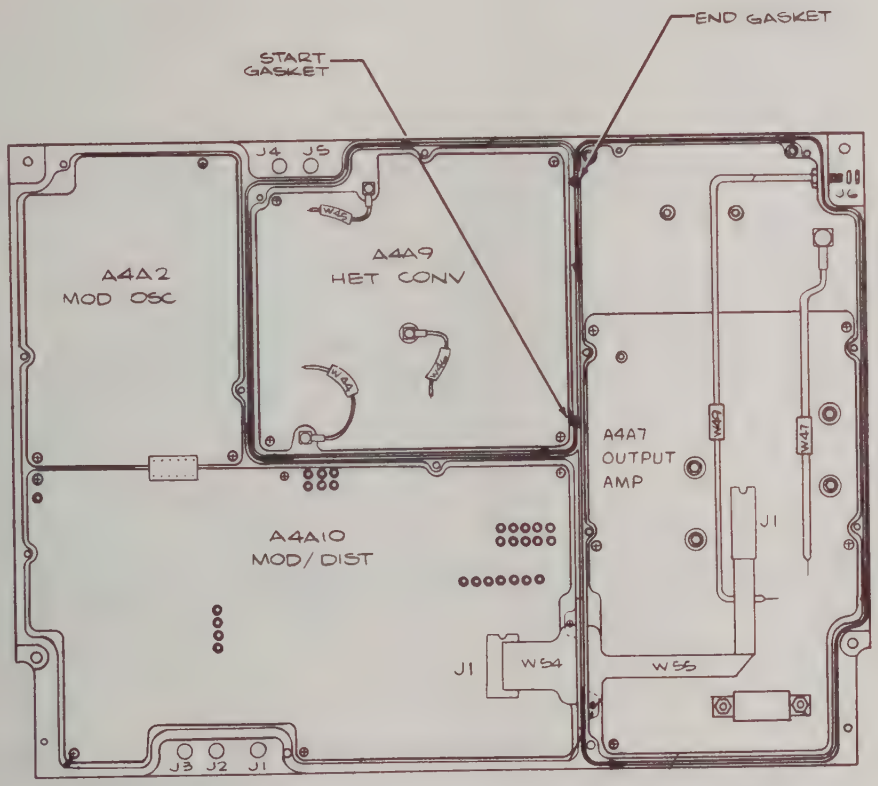


Figure 3-7. RF Gasket Positions - Bottom of Output Module

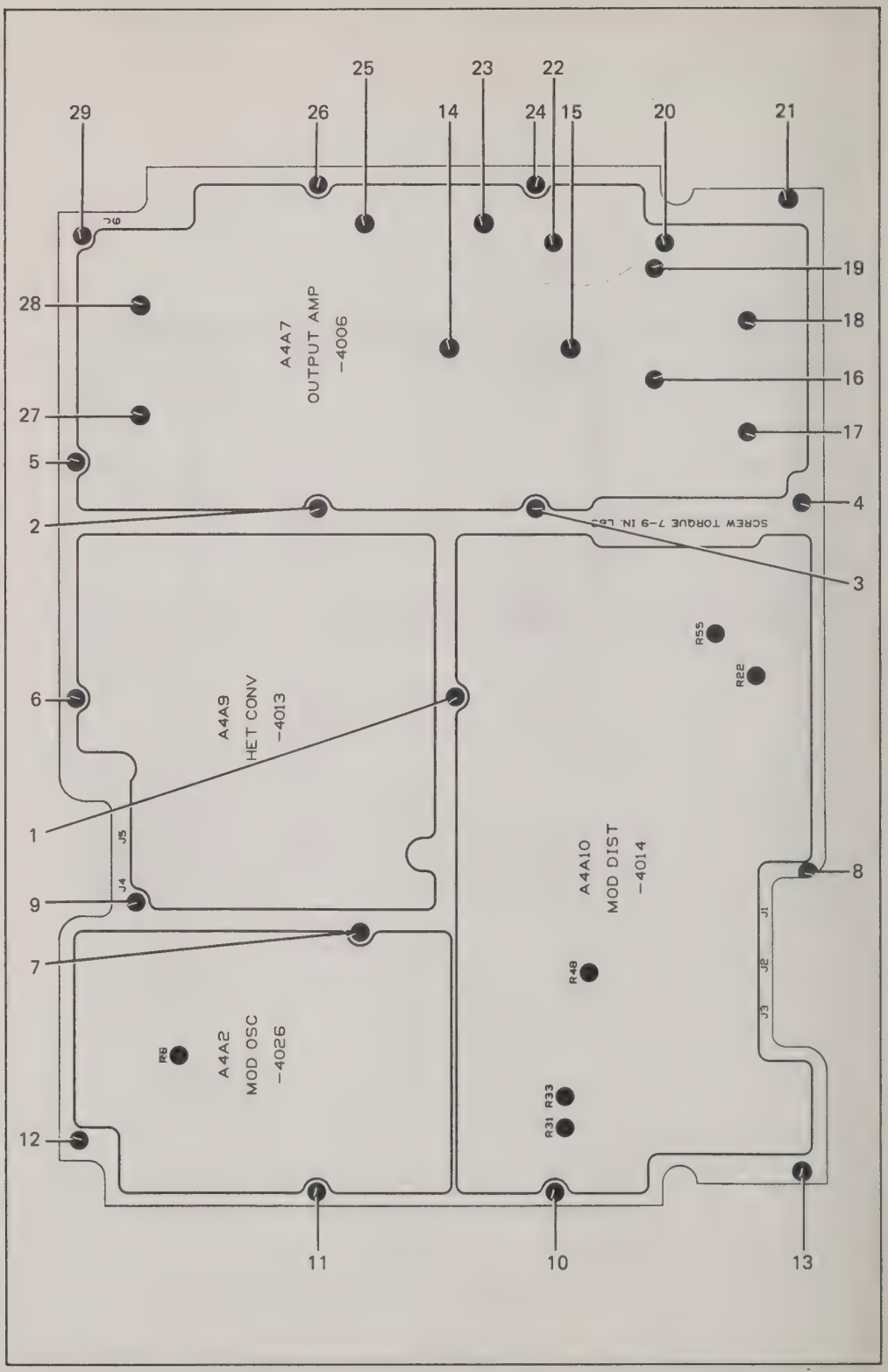


Figure 3-8. Output Module, Bottom Cover

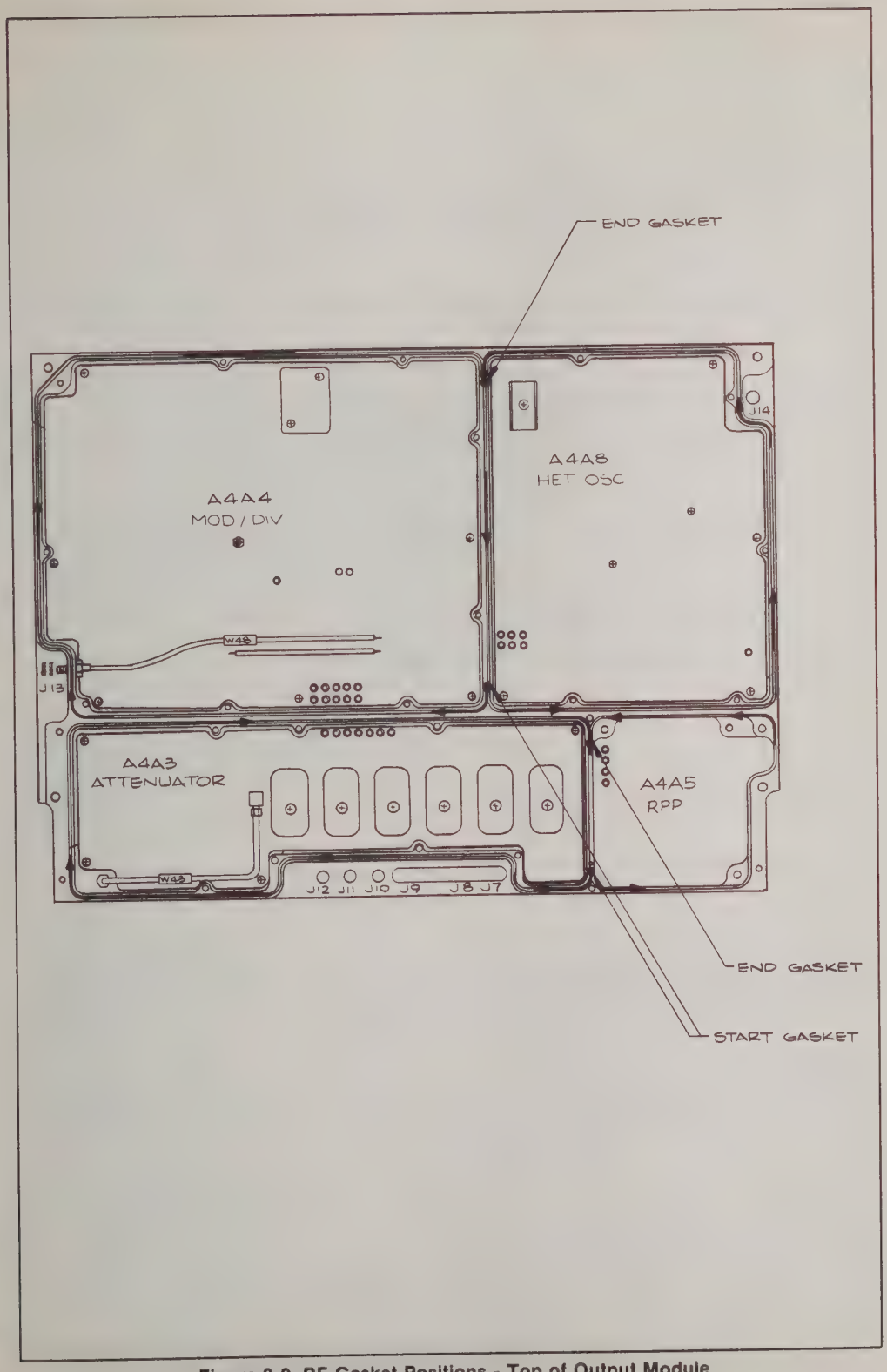


Figure 3-9. RF Gasket Positions - Top of Output Module

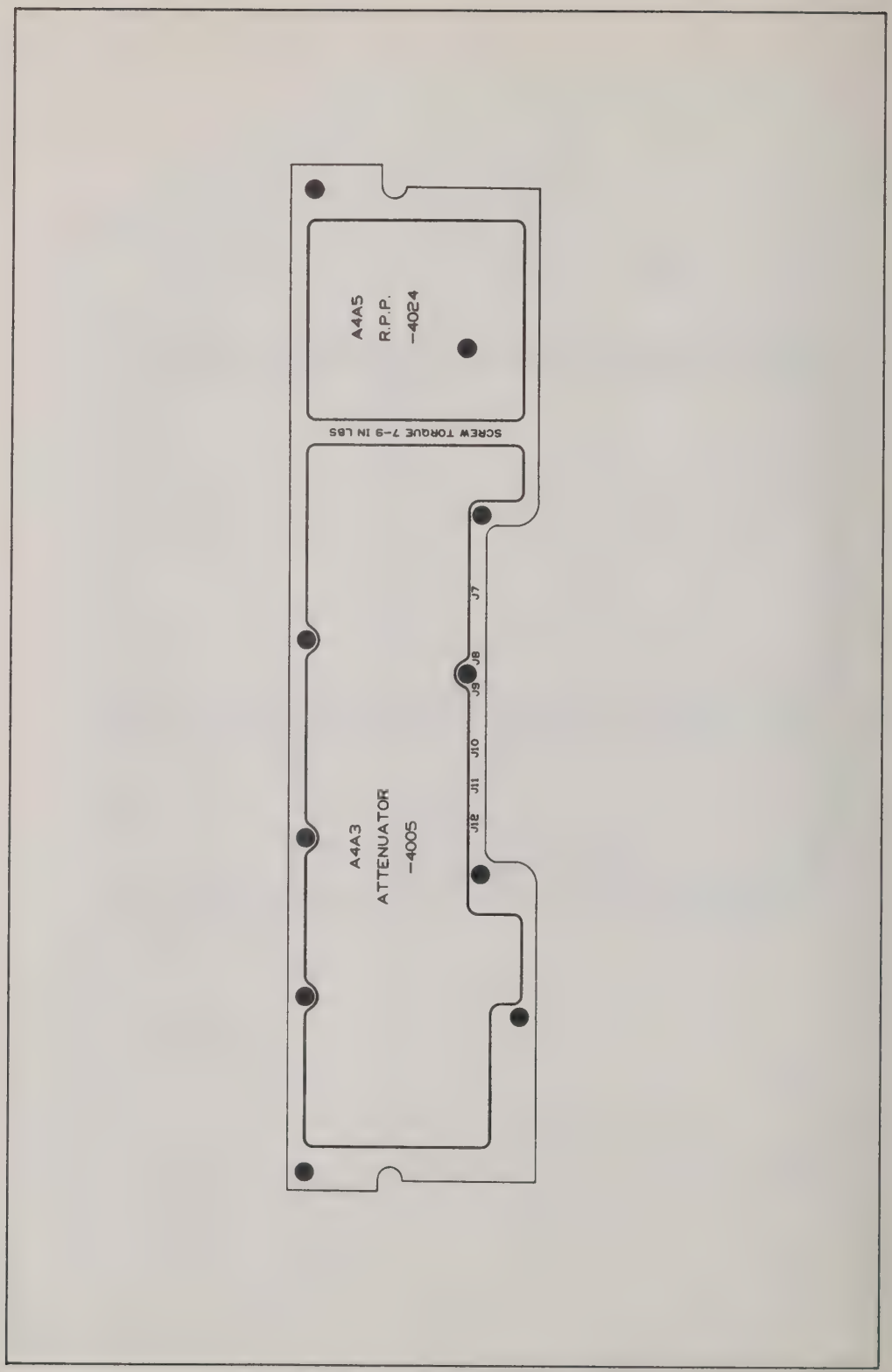


Figure 3-10. A4A5 RPP PCB Cover

Section 4
General Maintenance Procedure

4-1. INTRODUCTION

4-2. The information in this section describes the general maintenance procedures for the 6070A and the 6071A RF Synthesized Signal Generators. The procedures should be completed only the qualified personnel.

4-3. CLEANING PROCEDURE

4-4. Clean the instrument periodically to remove dust, grease, and other contamination. Use the following procedure:

1. Clean the interior with clean, dry, low pressure air (<20 psi).

2. Clean the front panel and exterior surfaces with a soft cloth dampened in a mild solution of detergent and water.

4-5. LINE POWER SELECTION PROCEDURE

4-6. The 6070A and the 6071A can operate in a 90 to 132V ac rms line voltage environment or in a 180 to 264V ac rms line voltage environment. Use the following procedure to select the desired line voltage:

1. Set the POWER control (front panel) to STBY, set the MAIN POWER switch (rear panel) to the OFF position, and disconnect line power.

2. Remove the six screws that hold the rfi shield over the main power fuse and the line voltage selection switch. This rfi shield is located just beneath the line power receptacle on the rear panel of the instrument. Figure 4-1 shows the main power fuse and the line voltage selection switch with the rfi shield removed.

3. Set the line voltage selection switch to the range of operation desired. The white window on the switch shows 115 for the 90 to 132V ac rms range and 230 for the 180 to 264V ac rms range. Figure 4-1 shows the 90 to 132V ac rms range selected.

4-7. FUSE REPLACEMENT PROCEDURES

4-8. Introduction

4-9. The instrument has two fuses: the main power fuse and the auxiliary power supply fuse. The main power fuse can be replaced from the rear panel. The auxiliary power supply fuse is located inside the instrument on the Power Supply Assembly.

4-10. Main Power Fuse Replacement Procedure

4-11. Use the following procedure to replace the main power fuse.

1. Set the POWER control (front Panel) to STBY, set the MAIN POWER switch (rear panel) to OFF, and disconnect line power.

2. Remove the six screws that hold the rfi shield over the main power fuse and the line voltage selection switch. This rfi shield is located just beneath the line power receptacle on the rear panel of the instrument. Figure 4-1 shows the main power fuse and the line voltage selection switch with the rfi shield removed.

3. Replace the main power fuse only with a 3A, 250V, FAST BLO fuse. Substitution of a different type fuse may result in damage to the instrument.

4-12. Auxiliary Power Supply Fuse Replacement Procedure

4-13. Use the following procedure to replace the Auxiliary Power Supply Fuse:

1. Set the POWER control (front panel) to STBY, set the MAIN POWER switch (rear panel) to OFF, and disconnect line power.

2. Remove the instrument covers using the Interior Access Procedure in Section 3.

3. Remove the Power Supply Assembly and access the auxiliary power fuse using the Power Supply Access Procedure in Section 3.

4. Replace this fuse only with a 0.6A SLOW BLO type. Substitution of a different type fuse may result in damage to the instrument.

5. Assemble the instrument using the access procedures in Section 3.

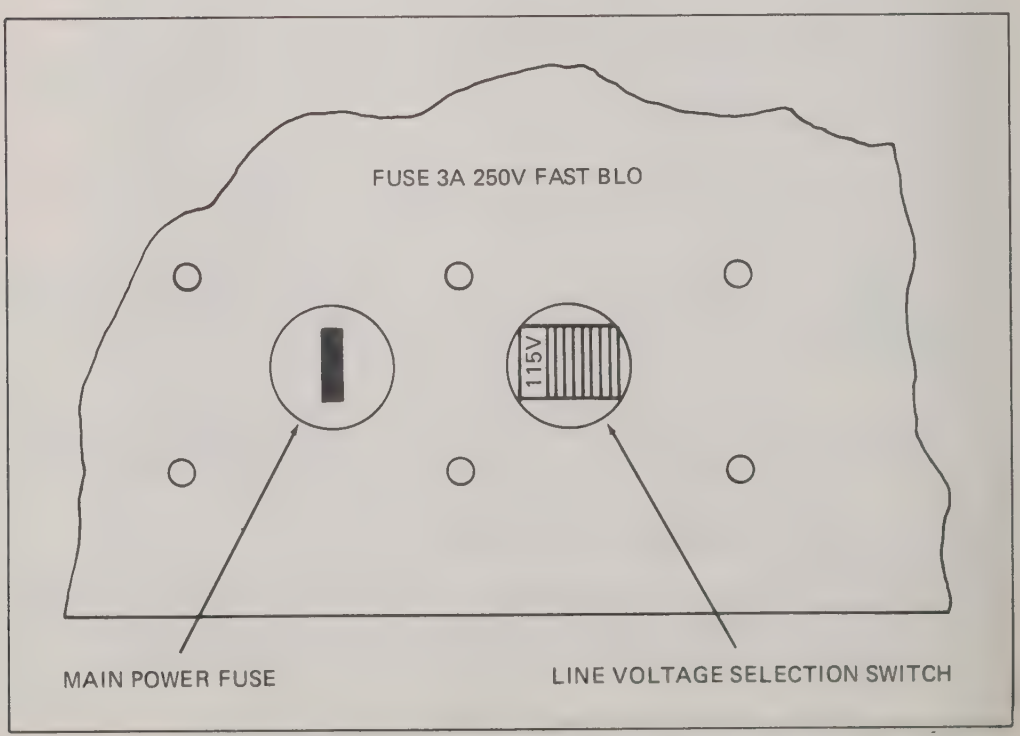


Figure 4-1. Main Power Fuse and Line Voltage Selection Switch

Section 5
Performance Checks

5-1. INTRODUCTION

5-2. The information in this section describes the performance checks for the 6070A and the 6071A Synthesized RF Signal Generator (the specifications in Table 1-2 are the performance standard). Use these checks at least once a year to verify the instrument performance. These performance checks also can be used as an acceptance check or for performance verification after completing repairs or routine maintenance on the instrument. It is recommended that the performance checks be completed in the order presented, but individual performance checks can be used as troubleshooting aids. The instrument being tested, the Unit Under Test (UUT), should be warmed up (POWER control at the ON position) with all covers in place for at least 30 minutes before starting the performance checks. The test equipment required for the performance checks is listed in Section 1 (Table 1-1) of this manual. If an out-of-range result is obtained, the instrument requires calibration adjustment and/or troubleshooting and repair.

5-3. POWER ON CHECK

PURPOSE:	Verify that the instrument turns on correctly and is functional.
TEST EQUIPMENT:	None
REMARKS:	1. The check is begun each time the POWER control is set to the ON position. 2. Press one of the FUNCTION controls to abort the check.

5-4. Complete the following steps to verify that the instrument turns on correctly and is functional.

1. Start with the instrument in standby (STBY indicator on).

2. Set the POWER control to ON.

3. The instrument starts the self tests and turns on all lighted controls, annunciators, indicators and every segment of each display for about 5 seconds.

4. After about 5 seconds, the front panel is set to the standard power on setup that follows unless one or more self tests fail. If the instrument has the 607XA-570 Non-Volatile Memory Option installed, the front panel is returned to the same setup that existed when the instrument was placed in standby or was turned off.

	ITEM	CONDITION
a.	RF OUTPUT Control	On (Lit)
b.	FREQUENCY Display	300 000 000
	Bright Digit Location	1 MHz Position
	Bright Digit is on.	
c.	REL FREQ	Off (Dark)
d.	AMPLITUDE Display	-10.0 dBm
	Bright Digit Location	1 dB Position
e.	REL AMPL	Off (Dark)
f.	Internal Amplitude Correction	Enabled
g.	MODULATION Controls	All Off (Dark)
h.	MODULATION Display	1.0 kHz
	Bright Digit Location	1.0 kHz Position
i.	Programmed Parameters:	
	Frequency Step (FREQ STEP)	25.000 kHz
	AM Depth (AM)	30%
	FM Deviation (FM/ØM)	5.0 kHz DEV
	TOP Memory Location (TOP)	9*
	Sweep Increment (SWP INCR)	1 MHz
	Sweep Width (SWP WDTH)	100 MHz
	Sweep Speed	Normal
j.	SWEEP Controls	Off
k.	IEEE-488 Interface Status:	
	LOCAL BUS STATUS CONTROL	Dark (LOCAL) Deferred mode (@0) RQS Mask is 11000000* Status Byte is Cleared. Trigger Configuration is Null.

*If the 6070XA-570 Non-Volatile Memory Option is installed, the front panel set up and the IEEE-488 bus parameters will be the same as when the instrument was placed in the standby except that the instrument will be in local.

5. If the instrument fails one of the self tests, the instrument model number (6070 or 6071) appears in the FREQUENCY Display and an error code indicating the test (s) failed appears in the AMPLITUDE Display. The display remains in this state until one of the FUNCTION controls is pressed. When one of the FUNCTION controls is pressed, the remainder of the front panel is set up as described in step 4. The self test error code can be interpreted using Table 5-1.

5-5. FRONT PANEL CONTROLS CHECK

PURPOSE:	Verify proper operation of all the front panel controls except for the POWER control, the Edit Knob, and the MOD OUT level control.
TEST EQUIPMENT:	None
REMARKS:	1. Select special function 04 to enable the check. 2. Press the CLEAR control to abort the check.

Table 5-1. Self Test Error Code Interpretation

The self test error codes are additive. For example, if the instrument failed the ROM test, the scratch pad memory RAM test, and the angle modulation test, the AMPLITUDE Display would be 0205:

ROM test failed	= 0 0 0 1
Scratch pad memory RAM test failed	= 0 0 0 4
Angle modulation test failed	= 0 2 0 0
AMPLITUDE Display	= 0 2 0 5

SELF TEST ERROR CODES (AMPLITUDE DISPLAY)	INTERPRETATION
blank	All tests passed.
0 0 0 1	ROM test failed.
0 0 0 2	Calibration PROM Test failed.
0 0 0 4	Scratch Pad Memory RAM Test failed.
0 0 1 0	Non-volatile Memory Test failed.
0 0 2 0	Mod/Divider Test failed.
0 0 4 0	Delay Discriminator Not Read Test failed.
0 1 0 0	Amplitude Modulation Test failed.
0 2 0 0	Angle Modulation Test failed.
0 4 0 0	Control Cable Continuity Test Error (Subsynthesizer, Mod Distribution, N/1)
1 0 0 0	Frequency Doubler (6071A only) Test failed.
2 0 0 0	Power On Template Recall failure.
4 0 0 0	Sub-synthesizer Test failed.
1 0 0 0 0	IEEE-488 Interface Test failed.
(-)X X X X X	Self Test was aborted with the partial result, (-)X X X X X.

5-6. Complete the following steps to verify proper operation of all the front panel controls except the POWER control, the Edit Knob, and the MOD OUT level control:

1. Select special function 04.

2. Press each of the front panel controls in the sequence listed in Table 5-2, and verify that the indicated two-digit code appears in the 10 kHz and 100 kHz positions of the FREQUENCY Display.

3. Press CLEAR UNITS. The instrument return to normal operation.

5-7. LED CHECK

PURPOSE: Verify proper operation of all segments of each display, the LED in each lighted control, and every indicator and annunciator.

TEST EQUIPMENT: None

REMARKS:

1. Select special function 03 to enable the check.

2. The check is automatic and will return the instrument to normal operation at the end of the check.

3. Press the CLEAR control to abort the check.

Table 5-2. Front Panel Controls Check

PRESS		CODE
CONTROL	CONTROL GROUP	
INT AM	MODULATION	00
INT FM/0M	MODULATION	01
EXT AM	MODULATION	02
EXT FM/0M	MODULATION	05
DC COUPLED	MODULATION	07
LOCAL (BUS ADDRS)	BUS STATUS	10
FREQ	FUNCTION	11
AMPL	FUNCTION	12
MOD FREQ (FREQ STEP)	FUNCTION	13
AM (SWP WDTH)	FUNCTION	14
SHIFT	FUNCTION	15
INTERROGATE		16
STORE (INSERT)	MEMORY	20
TOP	MEMORY	21
RECALL (DELETE)	MEMORY	22
NEXT ↓	MEMORY LOCATION	25
NEXT ↓	MEMORY LOCATION	26
TOP	MEMORY LOCATION	27
0	DATA	30
1	DATA	31
2	DATA	32
3	DATA	33
4	DATA	34
5	DATA	35
6	DATA	36
7	DATA	37
8	DATA	40
9	DATA	41
.	DATA	42
+/-	DATA	43
MHz/V	UNITS	44
kHz/mV	UNITS	45
Hz/uV	UNITS	46
Rad/dB(m)	UNITS	47
%	UNITS	50
	FREQ STEP	52
	FREQ STEP	53
AMPL	EDIT	54
MOD	EDIT	55
FREQ	EDIT	56
OFF	EDIT	57
MANUAL	SWEEP	61
SINGLE	SWEEP	62
AUTO	SWEEP	63
SLOW	SWEEP	64
OFF	SWEEP	65
REL FREQ		66
REL AMPL		67
ON	RF OUTPUT	70

5-8. Complete the following steps to verify proper operation of all front panel LEDS.

1. Select special function 03.

2. The instrument lights the front panel LEDs in the following sequence:

   a. Every segment of each display digit turns on, then off. Only one segment should be lit at a time.

   b. All segments of the MODULATION Display light, then turn off.

   c. All annunciators and indicators in the INTERROGATE display light, then turn off.

   d. All segments of the FREQUENCY Display light, then turn off.

   e. All segments of the AMPLITUDE Display light, then turn off.

   f. The remainder of the front panel annunciators and indicators turn on, then off, one at a time from top to bottom and left to right.

3. The instrument returns to normal operation.

5-9. SWP OUT, PEN LIFT, AND OUT VALID CHECK

PURPOSE:	Verify proper levels and timing of the instrument outputs: SWP OUT, PEN LIFT, and OUT VALID
TEST EQUIPMENT:	Oscilloscope, DVM
REMARKS:	The UUT and all test equipment must be a room temperature and must beoperating for at least 30 minutes before this check is started.

5-10. Complete the following steps to verify the proper levels and timing relationships of the OUT VALID, SWP OUT, and PEN LIFT outputs.

1. Connect the DVM input and Channel A of the oscilloscope to the SWP OUT connector on the UUT. Connect Channel B of the oscilloscope to the PEN LIFT connector on the UUT.

2. Set the oscilloscope for 2 V/division, dc coupled, and 2 msec/division.

3. Set the DVM to the 2V range.

4. Program the UUT to recall memory location 98 (standard power-on setup). Verify that the penlift output (Channel B of the oscilloscope) is at a TTL high.

5. Press and hold MANUAL SWEEP for 3 seconds or longer. Verify that the penlift output remains at a TTL high while MANUAL SWEEP is pressed, and that the penlift output goes to a TTL low when MANUAL SWEEP is released.

6. Press and release MANUAL SWEEP. Verify that the penlift output goes to a RRL high for approximately 2 seconds then returns to a TTL low.

7. Verify that the DVM is reading 0 ±0.01V at this time.

8. Use the UUT Edit Knob to manually sweep frequency up. Verify that the Channel A trace rises smoothly without any jumps. When the end of the sweep range is reached, frequency stops increasing. Verify that the DVM reading is 10 ±0.06V at this time.

9. Disconnect the oscilloscope and the DVM from the UUT SWP OUT connector and connect Channel A of the oscilloscope to the UUT OUT VALID connector.

10. Set the oscilloscope for 10 msec/division and press the OFF SWEEP control on the UUT. Verify that the penlift output (oscilloscope Channel B) goes to a TTL high.

11. Press and release MANUAL SWEEP and spin the Edit Knob past the end of the sweep range. Verify that as the knob is turned past the end of the sweep range, that the output valid signal (oscilloscope Channel A) pulses to a TTL low for approximately 6 msec.

5-11. SYNTHESIS AND DCFM SHIFT CHECK

PURPOSE:	1. Verify that the frequency of the signal at the RF OUTPUT connector is the same as the programmed frequency. 2. Verify that the frequency of the signal at the RF OUTPUT connector does not change excessively when the DCFM Mode is selected.
TEST EQUIPMENT:	Frequency Counter
REMARKS:	The UUT and all test equipment must be at room temperature and must be operating for at least 30 minutes before this check is started.

5-12. Complete the following steps to verify the frequency of the RF OUTPUT.

1. Connect the counter and the UUT as follows: counter 10 MHz REF IN connector to the UUT REF OUT connector and the UUT RF OUTPUT connector to the counter CHANNEL C input connector.

2. Program the UUT for an output level of 100 mV.

3. Program the UUT for the frequencies listed in Table 5-3 and verify that the counter displays the programmed frequency ±1 Hz.

5-13. Complete the following steps to verify that the frequency of the signal at the RF OUTPUT connector does not change excessively when the UUT shifts into the DCFM Mode.

1. Program the UUT for FM of 0 kHz DEV and an RF output frequency of 50 MHz.

2. Press EXT FM/0M and DC COUPLED MODULATION controls so that they light.

Table 5-3. Synthesis Check

100.000 000 MHz	
211.111 111 MHz	
322 222.222 kHz	
433 333.333 kHz	
444 444 444 Hz	
455 555 555 Hz	
466 666 666 Hz	
477 777 777 Hz	
488 888 888 Hz	
499 999 999 Hz	
250.001 000 MHz	
250.201 000 MHz	
250.309 999 MHz	
525.999 998 MHz	
519.999 999 MHz	(6071A ONLY)
50.000 000 MHz	

3. Verify that the DCFM MODE indicator lights and that the counter display is between 50.001 000 and 49.999 000 MHz.

5-14. FREQUENCY ACCURACY CHECK

PURPOSE:

1. Verify that the frequency of the UUT timebase is within specified limits.

2. Verify that the UUT remains locked onto a 10 MHz external reference while the reference varies up to ±80 Hz from the UUT standard timebase reference frequency.

3. Verify that the UUT loses lock, the FREQ UNCAL annunciator turns on.

TEST EQUIPMENT: Frequency Standard, Frequency Counter, and Low Frequency Synthesized Signal Generator (LF SSG)

REMARKS:

1. This procedure is for a UUT with a standard timebase. If the UUT has the 607XA-130 Oven Reference Option installed, also use the procedure in Section 7A to verify that the optional timebase frequency is within specified limits.

2. The UUT and all test equipment must be at room temperature and must be warmed up for at least 30 minutes before this check is started.

5-15. Complete the following steps to verify that the frequency of the UUT timebase is within specified limits. (If the 607XA-130 Optiuon is installed, use the procedure in Section 7A instead of this procedure, and go to paragraph 5-16.)

1. Connect the frequency standard output to the 10 MHZ REF IN connector on the counter.

2. Connect the UUT REF OUT connector to the counter CHANNEL A input connector.

3. Verify that the counter display is 10 MHz ±25 Hz.

4. Record the counter display (this 10 MHz frequency is referred to as Fo through the remainder of the Frequency Accuracy Check).

5-16. Complete the following steps to verify that the UUT remains locked onto a 10 MHz external reference while the reference varies up to ±80 Hz.

1. Connect the frequency standard output to the LF SSG EXT REF connector.

2. Connect the LF SSG output to the UUT REF IN connector.

3. Disable the UUT wideband reference (special function 60). Push SHIFT, then 6 DATA, then 0 DATA.

4. If the standard timebase is installed, continue to Step 5. If the 607XA-130 Oven Reference Option is installed, go to Step 7.

5. Program the LF SSG for Fo (Step 4, paragraph 5-15) at a level of 110 mV, VRMS, TERMINATED.

6. Edit the LF SSG output in 10 Hz steps up to Fo + 80 Hz and down to Fo –80 Hz. Verify at each step that the FREQ UNCAL annunciator does not turn on and that the counter reading agrees with the LF SSG frequency setting. Go to 5-17.

7. Program the LF SSG for a 10 MHz output at a level of 110 mV, VRMS, TERMINATED.

8. Edit the LF SSG in 10 Hz steps up from 10 MHz until the FREQ UNCAL annunciator lights. Record this LF SSG frequency as Fplus.

9. Edit the LF SSG in 10 Hz steps down from 10 MHz until the FREQ UNCAL annunciator lights. Record this LF SSG frequency as Fminus.

10. Verify that Fplus - Fo and Fo - Fminus are both greater than 60 Hz and that Fplus - Fminus is greater that 160 Hz.

5-17. Verify that as the UUT loses lock the FREQ UNCAL annunciator turns on.

1. Begin this procedure at the end of the last procedure.

2. Edit the LF SSG frequency first above and then below 10 MHz until the FREQ UNCAL annunciator lights (typically 130 Hz above and below 10 MHz).

5-18. RF HARMONIC CHECK

PURPOSE: Verify that the RF harmonics produced by the instrument are within specified limits.

TEST EQUIPMENT: High Frequency Spectrum Analyzer

REMARKS:

1. If the UUT is a 6070A, complete only the steps that check both the 6070A and the 6071A (first paragraph in the procedure).

2. If the UUT is a 6071A, complete all steps of the procedure.

3. The UUT and all test equipment must be at room temperature and must be operating for at least 30 minutes before this check is started.

5-19. Complete the following steps to check the harmonics of both the 6070A and the 6071A.

1. Connect the UUT RF OUTPUT to the High Frequency Spectrum Analyzer input.

2. Set the High Frequency Spectrum Analyzer controls to +20 dBm full scale, 10 dB log, and the remainder for convenient viewing.

3. Program the UUT for the outputs listed in Table 5-4 and set up the High Frequency Spectrum Analyzer as required. Verify that the RF harmonics are better than or equal to the listed limits.

Table 5-4. RF Harmonics Check

PROGRAMMED UUT OUTPUT		HARMONICS LIMIT (dBc)			
		WITHOUT 607XA-870 RPP OPTION		WITH 607XA-870 RPP OPTION	
FREQUENCY	LEVEL (dBm)	6070A	6071A	6070A	6071A
200 kHz	+13	-35		-35	-35
	+19			-30	-30
10 MHz	+13			-35	-35
	+19			-30	-30
124 MHz	+13			-35	-35
	+19			-30	-30
249 MHz	+13			-35	-35
	+19	-35	-30	-30	-25
519 MHz	+13	-35	-35	-35	-35
	+19	-35	-25	-25	-20
6071A ONLY					
521 MHz	+6.9		-25		-25
	+13				

5-20. Complete the following steps to check the RF harmonics of the 6071A only:

1. If the UUT is a 6070A, go to the next performance check. If the UUT is a 6071A, go to the next step of this procedure.

2. Set the High Frequency Spectrum Analyzer controls to +20 dBm full scale, 10 dB log, and the remainder for convenient viewing.

3. Program the UUT for the outputs listed in Table 5-5 and set up the HF Spectrum Analyzer as required. Verify that the RF harmonics are better than or equal to the listed limits.

4. Set the High Frequency Spectrum Analyzer controls to +10 dBm full scale, full scan, and maximum bandwidth.

5. Program the UUT for an RF output of 520 MHz at a level of +6.9 dBm with all MODULATION controls off (dark). Press EDIT FREQUENCY and use the DIGIT controls to place the Bright Digit in the 1MHz position of the FREQUENCY Display.

6. Rotate the Edit Knob so that the RF output frequency increases to 1040 MHz while observing the High Frequency Spectrum Analyzer for F/2 and 3F/2 harmonics. Verify that all harmonics are less than –35 dBc.

Table 5-5. 6071A Harmonics Check

PROGRAMMED UUT OUTPUT		HARMONICS LIMIT (dBc)	
FREQUENCY (MHz)	LEVEL (dBm)	WITHOUT 607XA-870 RPP OPTION	WITH 607XA-870 RPP OPTION
		6071A	6071A
750	+6.9 +13	-25	-25
1000	+6.9 +13		

5-21. GENERATOR SOURCE IMPEDANCE (SWR) CHECK

PURPOSE: Verify the Source SWR performance of the UUT.

TEST EQUIPMENT: Y6002, NARDA 3020 Coupler, High Frequency Spectrum Analyzer

REMARKS:

1. The SWR test limits in this procedure account for the specific loss of the Y6002 SWR Test Cable. If another cable is used in the place of the Y6002, the loss versus frequency for the replacement cable must be measured and taken into account as explained in the Y6002 Replacement material at the end of this procedure.

2. The UUT and all test equipment must be at room temperature and must be operating for at least 30 minutes before this check is started.

5-22. The Check

5-23. Complete the following steps to verify the SWR performance of the UUT.

1. Connect the UUT and test equipment as shown in Figure 5-1.

2. Set the High Frequency Spectrum Analyzer controls as follows:

CENTER FREQUENCY	Table 5-6
FREQUENCY SPAN/DIV	20 MHz
LOG	2 dB/DIV
PERSISTANCE	MAX

Set the rest of the controls for convenient viewing.

3. On the UUT, use the EDIT FREQ and DIGIT controls to place the Bright Digit in the 100 kHz position of the FREQUENCY Display.

4. Verify SWR performance using Table 5-6.

a. For each line in Table 5-6, set the CENTER FREQUENCY of the High Frequency Spectrum Analyzer to the indicated value and program the UUT RF output to the listed START FREQUENCY at the corresponding LEVEL.

b. Rotate the Edit Knob to increase the UUT RF output to the stop frequency while watching the High Frequency Spectrum Analyzer for adjacent maximum and minimum amplitude ratio encountered.

c. Verify that the largest maximum/minimum amplitude ratio is within the appropriate limit listed in Table 5-6.

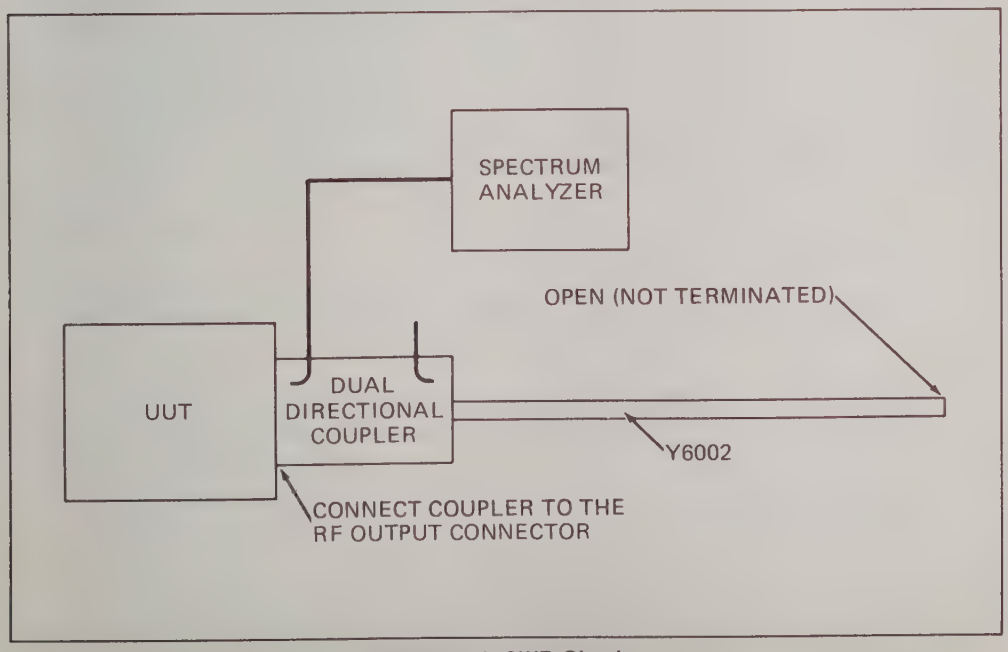


Figure 5-1. SWR Check

Table 5-6. SWR Check

PROGRAMMED UUT OUTPUT			HIGH FREQUENCY SPECTRUM ANALYZER CENTER FREQUENCY (MHz)	MAXIMUM ALLOWABLE MAX/MIN AMPLITUDE AMPLITUDE RATIO (dB)	SWR SPECIFICATIONS
FREQUENCY (MHz)		LEVEL (dBm)			
START	STOP				
120	320	+13.1 +7.0 +6.9	220	4.8	2.0:1
				2.8	1.5:1
320	520	+13.1 +7.0 +6.9	420	4.2	2.0:1
				2.6	1.5:1
6071A ONLY					
520	720	+7.0 +1.0 +0.9	620	5.4	2.5:1
				4.0	2.0:1
720	920	+7.0 +1.0 +0.9	820	5.0	2.5:1
				3.7	2.0:1
920	1040	+7.0 +1.0 +0.9	1020	4.8	2.5:1
				3.7	2.0:1

5-24. Test Cable Alternate

5-25. The Y6002 SWR Test Cable should be used for the Generator Source Impedance (SWR) Check because the SWR test limits (Table 5-6) account for the specific loss of the Y6002. If a test cable other than the Y6002 is used, the loss of the replacement cable versus frequency must be measured and must be taken into account in determining the correct values for the Maximum Allowable Max/Min Ratio column in Table 5-6. The replacement cable should be approximately 25 feet log and, preferable, have less the 2.0 dB loss at 1 GHz. Use the following procedure to calculate the correct Maximum Allowable Max/Min Ratio value for a specific frequency band:

1. Measure the one-way loss of the cable at the center of the frequency band. Let this loss be represented by L.

2. Use the following formula to calculate the Maximum Allowable Max/Min Ratio in dB:

$$\text{Maximum Allowable Max/Min Ration} = 20 \log_{10} \frac{1+rk}{1-rk}$$

Where: $r = \frac{S-1}{S+1}$ where S is the SWR specification listed in Table 5-6.

$k = 10^{(L/10)}$ where L is from Step 1.

5-26. For an example of Y6002 replacement, assume that the SWR Specification from Table 5-6 is 2.0:1 and the measured one-way cable loss is 2 dB at the frequency of interest:

$$r = \frac{S-1}{S+1} = \frac{1}{3} = 0.333$$

$$k = 10^{-(L/10)} = 10^{-0.2} = 0.631$$

Therefore:
Maximum Allowable Max/Min Ratio $= 10 \log_{10} \frac{1+rk}{1-rk}$

$$= 20 \log_{10} \frac{1+.333(.631)}{1-.333(.631)}$$

$$= 3.71 \text{ dB}$$

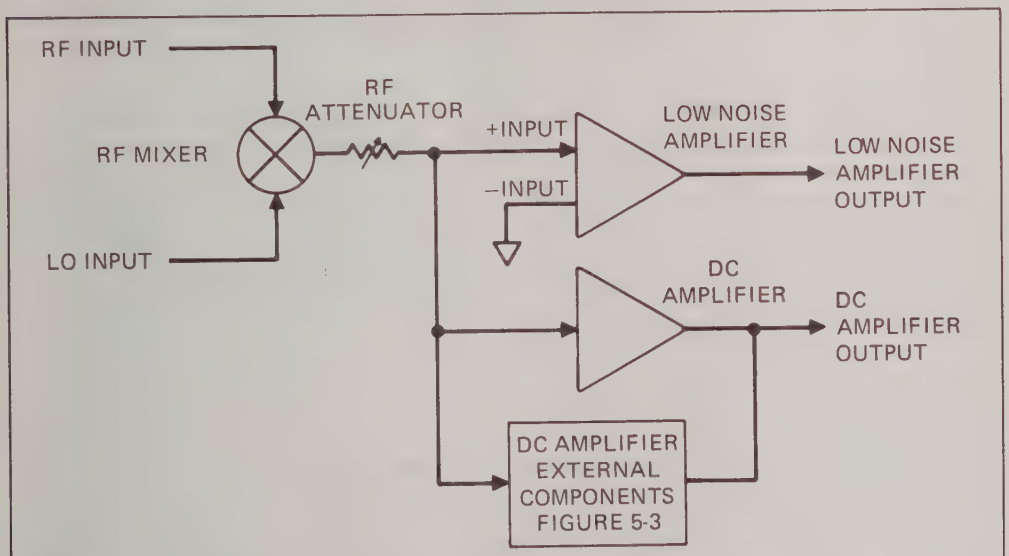
5-27. SPURIOUS OUTPUT CHECKS

5-28. Introduction

5-29. The following information describes a spur test system and three methods that check for spurious output signals (spurs): Direct Spur Check, the Direst Through Low Pass/High Pass Filter Spur Check, and the Mixer Carrier Null Spur Check. It is recommended that these checks be completed in the sequence listed.

5-30. Spur Test System

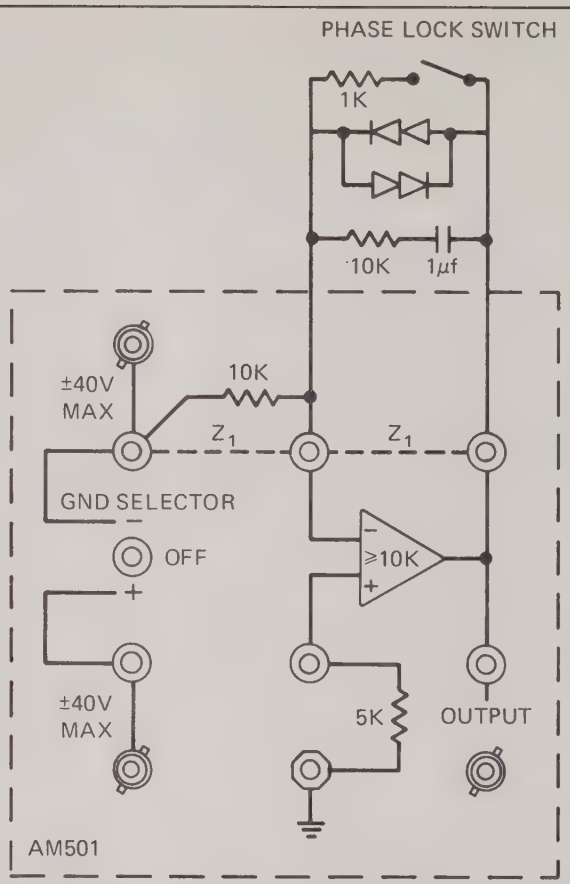
5-31. Figure 5-2 is a block diagram of the spur test system. Figure 5-3 shows the circuit and lists the components required for the DC Amplifier. The recommended DC Amplifier, the TEK AM501, has front panel connections for external components. This spur test system is used for both the Surious Output Checks and the Phase Noise Check.



SET THE LOW NOISE AMPLIFIER CONTROLS AS FOLLOWS:

STEP GAIN	MIDDLE OF RANGE OF TRAVEL
OUT: NORMAL	NORMAL
GAIN	200
GAIN CAL	CAL
HF-3 dB	1 MHz
LF-3 dB	10 Hz
+INPUT, AC	IN
–INPUT, GND	IN

Figure 5-2. Spur Test System



LIST OF EXTERNAL COMPONENTS

DESCRIPTION	FLUKE STOCK NO.	MFG. PART NO.	QTY.
Capacitor, 1uf, polysterene	105924	Electron Product, E6-105	1
Diode, multipellet	375477	GE, MPD 200	2
Resistor, 1 kOhm	148023		1
Resistor, 5 kOhm	479378		1
Resistor, 10 kOhm	148106		2
Switch, Momentary Contact	157156	Grayhill, 4000	1

Figure 5-3. DC Amplifier External Circuit

5-32. Direct Observation Spur Check

PURPOSE:	Verify spur performance by direct observation.
TEST EQUIPMENT:	Low Frequency Spectrum Analyzer
REMARKS:	The UUT and all test equipment must be at room temperature and must be operating for at least 30 minutes before this check is started.

5-33. Complete the following steps to verify spur performance by direct observation:

1. Observe the power line related, display related, and fan related spurs.

a. Connect the UUT RF OUTPUT to the Low Frequency Spectrum Analyzer input.

b. Program the UUT for an Rf output of 1 MHz at a level of 0 dBm.

c. Set the Low Frequency Spectrum Analyzer controls as follows:

DISPLAY STORAGE	A and B on (all others off)
REFERENCE LEVEL	
LOG 10 dB/DIV	On
INPUT BUFFER	Off
TRIGGERING	
FREE RUN	On
NORM	On
DIGITAL STORAGE	
BASELINE CLIPPER	Top of screen
DOT FREQUENCY	1 MHz
FREQUENCY SPAN/DIV	50 Hz/DIV
RESOLUTION (Hz)	10
TIME/DIV	10 SEC/DIV
(tune) REFERENCE LEVEL	0 dBm
Input Termination	50 Ohm
Input Ref dBm 50 Ohms	

d. On the Low Frequency SpectrumAnalyzer, rotate DOT MARKER so that the displayed signal is at the left edge reference line, and rotate LEVEL so that the peak of the displayed signal is at the top amplitude.

e. Carefully examine the Low Frequency Spectrum Analyzer display for spurs at the frequencies listed in Table 5-7 and verify that all spurs are at least –56 dBc. To differentiate power line related spurs from display related spurs, turn off the UUT displays by selecting special function 05 (press SHIFT and then the 0 and 5 DATA controls). This is an instrument self test. One LED flashes while the test is in progress and the instrument returns to Power On setup once the test has been completed. If you need more time, select the test again.

Table 5-7. Line Power, Display, and Fan Spurs

SPUR SOURCE	FREQUENCY OFFSETS (in Hz) FROM 1 MHz CARRIER			
LINE POWER/ DISPLAY	60	120	180	
FAN	75 to 95	150 to 190	225 to 285	300 to 380

2. Observe the display related and microprocessor related spurs:

a. Set the Low Frequency Spectrum Analyzer FREQUENCY SPAN/DIV control to 200 Hz/DIV and set the TIME/DIV control to 10 SEC/DIV. Rotate

the DOT MARKER and LEVEL controls as necessary to place the left edge of the displayed signal on the left edge reference line and the top peak of the signal on the top amplitude reference line.

b. Carefully examine the Low Frequency Spectrum Analyzer display for spurs at the offset frequencies listed in Table 5-8. Verify that all spurs are –70 dBc for offsets greater than 550 Hz and less than –56 dBc for offsets less than 550 Hz.

Table 5-8. Display and Microprocessor Spurs

SPUR SOURCE	FREQUENCY OFFSETS (in Hz) FROM 1 MHz CARRIER
DISPLAY	500 ±20, 1500 ±30, 1000 ±40, (1000n) ±(40n)
MICROPROCESSOR	500 ±20, 1500 ±30, 1000 ±40, (1000n) ±(40n)
Where: n = The number of the harmonic being checked. Example: The fifth harmonic offset would be in the area of 5000 ±200 Hz	

5-34. Direct Through Low Pass/High Pass Filter Spur Check

PURPOSE:	Verify spur performance by direct observation.
TEST EQUIPMENT:	Low Frequency Spectrum Analyzer, Low Pass Filter, High Frequency Spectrum Analyzer, DC Block (High Pass Filter).
REMARKS:	The UUT and all test equipment must be at room temperature and must be operating for at least 30 minutes before this check is started.

5-35. Complete the following steps to verify spur performance by direct observation:

1. Before making any connections, set the equipment up as follows:

   a. Set the Low Frequency Spectrum Analyzer controls as follows:

DOT FREQUENCY	450 kHz
DOT MKR	center
FREQUENCY SPAN/DIV	1 kHz
RESOLUTION (Hz)	COUPLED
TIME/DIV	AUTO
INPUT TERMN Z	50 Ohms
INPUT REF	50 Ohms dBm
REF LEVEL	–60 dBm

   b. Program the UUT for an output of 450 kHz at a level of –100 dBm, select special function 00, and press all the MODULATION controls so that they are dark.

2. Connect the RF OUTPUT of the UUT to the input of the Low Frequency Spectrum Analyzer through the Low Pass Filter. Verify that the 450 kHz signal is at the –40 dB line on the Low Frequency Spectrum Analyzer. This means that the –40 dB line on the analyzer is the equivalent of –100 dBm from the UUT. Adjust LEVEL on the Low Frequency Spectrum Analyzer as necessary.

3. Change the equipment setup as follows:

   a. Set the Low Frequency Spectrum Analyzer controls as follows:

FREQUENCY SPAN/DIV	0
RESOLUTION	1 kHz (this is 26 dB BW factor)
TIME/DIV	10S

   b. Press the REL FREQ control so that it is lit. Program the UUT for an output of 5 MHz at a level of +1 dBm.

4. Verify that the trace (noise) on the Low Frequency Spectrum Analyzer is less than –129 dBc. Since the –40 dB line on the analyzer is equivalent to –100 dBm, the –40 dB line on the analyzer is equivalent to –127 dBc.

NOTE

The value of the –40 dB line was calculated using the formula:
–100 dBm – X –(+1 dBm)
where X is the equivalent noise bandwidth factor. For the TEK 7L5, 1 kHz bandwidth, X= 26 dB. Therefore, –100 dbm – 26 dB – (+1 dBm) = –127 dBc.

5. Change the equipment setup as follows:

   a. Set the RESOLUTION control on the Low Frequency Spectrum Analyzer to the 100 Hz position.

   b. Store a reference frequency of 450 kHz, then sequentially program the UUT for the relative frequencies listed below and verify at each frequency that the trace on the Low Frequency Spectrum Analyzer is less than 90 dBc (remember that the –40 dB line on the analyzer is equivalent to –101 dBc).

   UUT frequencies: 12, 14, 16, 18, 10, 20, 30, 40, 50, 60 MHz

NOTE

The Low Frequency Spectrum Analyzer SPAN control is set to zero span width and is always tuned to 450 kHz, so slow sweep speed is always averaging the result. There is no need to wait for a complete scan.

6. Set up the equipment as follows:

   a. Press the REL FREQ control so it is dark and connect the UUT to the High Frequency Spectrum Analyzer through the DC Block.

   b. Program the High Frequency Spectrum Analyzer for 520 MHz, –90 dBm, FREQUENCY SPAN 50 kHz/DIV, and calibrate at –90 dBc.

   c. Program the UUT for an RF output frequency of 100 kHz at a level of 0 dBm.

7. Verify that the spurs at 519.9 and 520 MHz are less than -90 dBc.

5-36. Mixer Carrier Null Spur Check

PURPOSE:	Verify spur performance by using a LO (6071A) and an RF Mixer to cancel the carrier and to provide a zero difference beat frequency that can be examined for spurs on the High Frequency Spectrum Analyzer.
TEST EQUIPMENT:	High Frequency Spectrum Analyzer, Spur Test System, UHF Synthesized Signal Generator (UHF SSG), Low Frequency Synthesized Signal Generator (LF SSG), Oscilloscope.
REMARKS:	The UUT and all test equipment must be at room temperature and must be operating for at least 30 minutes before this check is started.

5-37. Complete the following steps to perform the Mixer Carrier Null Spur Check:

1. Program the UUT for a 0 dBm output level and program the LO for a +8 dBm output level.

2. Connect the equipment as shown in Figure 5-4.

3. Set up the equipment as follows:

a. Set the Low Frequency Spectrum Analyzer controls as follows:

DISPLAY A&B	On
INPUT BUFFER	OFF
BASELINE CLIPPER	To the top of the screen
TRIGGER	FREE RUN
NORM	On
REFERENCE LEVEL	–10 dB
INPUT TERMINATION	50 ohms
INPUT REFERENCE	dBm 50 ohms
FREQUENCY SPAN/DIV	5 kHz
RESOLUTION	COUPLED
DOT FREQUENCY	20 kHz
DOT MARKER	Center
SWEEP	AUTO

b. Program the LF SSG for an output of 20 kHz at a level of 0.766 mV, terminated.

c. Set up the oscilloscope so that:

1. Channel 1 is 50 mV/div, dc coupled, trace in upper half of the CRT.

2. Channel 2 is 0.2V/div, ac coupled, trace in the lower half of the CRT.

3. Sweep time is 1 msec/div.

d. Program the UHF SSG for an RF output frequency of 350 MHz, a level of +8 dBm, and an FM deviation of 9 kHz DEV. Turn on the EXT FM, ØM and the DC COUPLED controls.

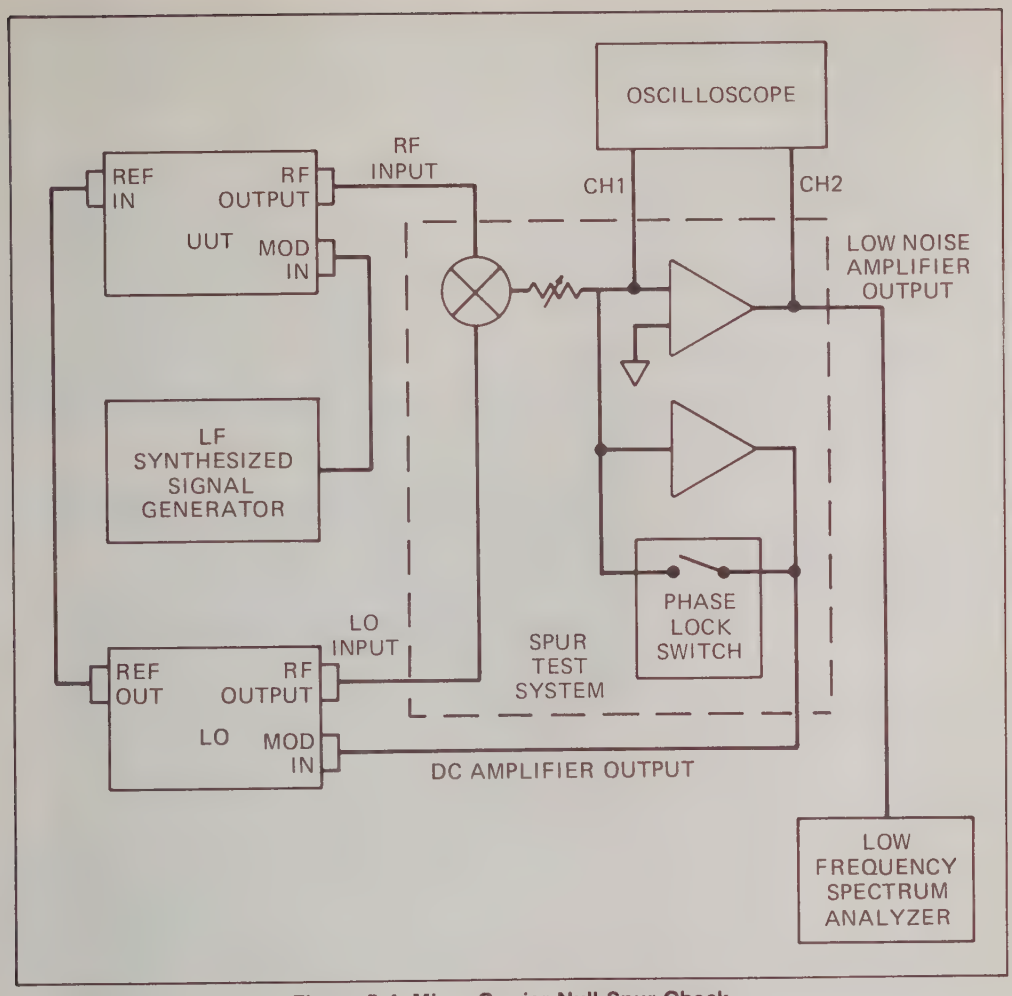


Figure 5-4. Mixer Carrier Null Spur Check

e. Program the UUT for an output of 350 MHz at a level of 0 dBm, select special function 00, program a FM deviation of 20 kHz DEV. Turn on the EXT FM/ØM control and turn off the DC COUPLED control.

f. Rapidly press and release (tap) the Phase Lock switch on the spur test system until the Channel 1 trace on the oscilloscope is 0V ±10 mV. This indicates that the UUT and the UHF SSG RF output signals are phase locked.

4. Calibrate the assembled test system as follows:

a. Set the REFERENCE LEVEL control on the Low Frequency Spectrum Analyzer so that the 20 kHz signal is at the -10 dB line. This means that the 0 line on the analyzer is now equivalent to -50 dBc and the -50 line on the analyzer is equivalent to -100 dBc.

NOTE

Lock between the UUT and the LO must be maintained at all calibration points and during subsequent measurements.

b. Sequentially program both the LO and the UUT for RF output frequencies of 10, 50, 100, 200, 250, 400, 500, and, if the UUT is a 6071A, 800 MHz. At each frequency, record the error in dB from the level at the original frequency of 350 MHz.

c. Verify that the error at 10 MHz and 50 MHz is less than +2 dB and less than ±1 dB at all other points.

5. Establish the proper phase relationship between the UUT and the LO RF output frequencies as follows:

a. Turn off the EXT FM/ØM controls on the LO and the UUT.

b. Disconnect the DC Amplifier Output of the spur test system from the MOD IN connector on the LO.

c. Use the UUT Edit Knob to quickly change the UUT RF Output frequency up 1 Hz and back down 1 Hz. Repeat this step until the Channel 1 trace on the oscilloscope is 0V ±10 mV.

6. Set the Low Frequency Spectrum Analyzer controls as follows:

FREQUENCY SPAN/DIV	50 Hz
RESOLUTION (Hz)	10
DOT FREQUENCY	0 Hz
DOT MARKER	to left edge

7. Check for spurs at the line and fan frequency and for display/microprocessor spurs. Verify that the spurs at the line and fan frequency are less than –56 dBc and that the display/microprocessor spurs are less than 70 dBc. The display and line frequency spurs may be difficult to distinguish. If so, select special function 05 to turn off the display (one LED will flash). It may be necessary to turn off the displays on both the UUT and the LO.

8. On the Low Frequency Spectrum Analyzer, set the FREQUENCY SPAN/DIV control to 200 Hz and set the TIME/DIV control to 10 S. Verify that the spurs above 550 Hz are less than –70 dBc.

9. Change the equipment setups as follows:

a. Press the EXT FM/ØM and the DC COUPLED controls on the LO so that they are lit.

b. Connect the DC Amplifier Output of the spur test system to the MOD IN connector on the LO.

c. Set the Low Frequency Spectrum Analyzer controls as follows:

FREQUENCY SPAN/DIV	50 Hz
RESOLUTION (HZ)	10
Dot	Mid Screen
DOT FREQUENCY	Edit to 2 kHz (Fine Tune On)

10. Program the UUT and the UHF SSG for the frequencies listed in Table 5-9. Verify that the spurs listed are less than the specified value (the 0 line on the analyzer is equivalent to –50 dBc). Edit DOT FREQUENCY as necessary.

Table 5-9. 2 kHz and 10 kHz Spurs

RF OUTPUT FREQUENCIES (MHz)		SPUR (KHz)	SPECIFIED LIMIT (dBc)
UUT	UHF SSG		
300.250005 300.250500	300.250 300.250	2	–70
299.999998	300	10	–90

11. Change the equipment setup as follows:

a. Program the UHF SSG for an RF output of 500.3 MHz at a level of +8 dBm and press the EXT FM/ØM and the DC COUPLED controls on the UHF SSG so that they are dark. Use the EDIT FREQ and DIGIT controls to place the Bright Digit in the 1 kHz position of the FREQUENCY Display.

b. Move the DC Amplifier Output of the spur test system to the MOD IN connector on the UUT.

c. Program the UUT for an RF output of 500.3 MHz at a level of 0 dBm and program FM to 49 kHz DEV. Press the EXT FM/0M and the DC COUPLED controls so that they are lit.

12. Rapidly press and release the Phase Lock Switch.

13. Slowly edit the UHF SSG RF output frequency to 500.325 MHz while maintaining lock as indicated by the Channel 2 trace of the Oscilloscope.

14. Change the Low Frequency Spectrum Analyzer setup as follows:

DOT FREQUENCY	0
Dot	One graticule line from the left
FREQUENCY SPAN/DIV	200 Hz
RESOLUTION (Hz)	COUPLED
TIME/DIV	COUPLED

15. Check for spurs at 500, 1000, 1500, and 2000 Hz. Verify that all spurs are less than –70 dBc (the –40 line is equivalent to –90 dBc).

16. Change the Low Frequency Analyzer setup as follows:

DOT FREQUENCY	10 kHZ
Dot	One graticule line from the left
FREQUENCY SPAN/DIV	1 kHz
RESOLUTION (Hz)	100

17. Verify that all spurs are less than –90 dBc (the –40 line is equivalent to –90 dBc).

18. Set up the equipment as follows:

a. Program the UUT for an RF output frequency of 250 MHz and turn off all MODULATION controls.

b. Move the DC Amplifier Output of the spur test system to the MOD IN connector of the UHF SSG.

c. Program the UHF SSG for an RF output frequency of 250 MHz and an FM of 9 kHz DEV and turn on the EXT FM/0M and DC COUPLED controls.

d. Change the Low Frequency Spectrum Analyzer setup as follows:

DOT FREQUENCY	50 kHz
DOT MARKER	Mid-screen
FREQUENCY SPAN/DIV	1 kHz
RESOLUTION	COUPLED

19. Look for spurs from 20 to 100 khz. Verify that all the spurs are less than -90 dBc. Change DOT FREQUENCY as necessary.

20. Program the LO and the UUT for the RF output frequencies listed inTable 5-10. Repeat step 20 for each frequency.

Table 5-10. 50 kHz and 100 kHz Spurs

UUT AND UHF SSG RF OUTPUT FREQUENCY (MHz)	SPUR (kHz) (APPROXIMATELY ±10%)
500	50 100
50	50 100

21. On the UUT, select special function 21 (HI DEV Mode on), set the RESOLUTION (HZ) control on the analyzer to 30, and repeat the preceeding step.

22. Set the equipment up as follows:

a. Select special function 20 (HI DEV Mode off) on the UUT and program the UUT for an RF output frequency of 350 MHz and a frequency step size of 100 kHz.

b. Program the UHF SSG for an RF output frequency of 350.001 MHz and a frequency step size of 100 kHz.

c. Set the analyzer DOT FREQUENCY to 100 kHz.

23. Simultaneously set up the UHF SSG and the UUT RF output frequencies to 351.1 and 351.101, respectively. At each 100 kHz step,verify that lock is maintained and that the 100 kHz spur is less than -90 dBc (the 50 line is equivalent to 100 dBc).

24. Set the analyzer DOT FREQUENCY to 200 kHz. Simultaneously step down the UUT and the UHF SSG RF output frequencies to 350 and 350.001 MHz, respectively, observing at each 100 kHz step that lock is maintained and that the 200 kHz spur is less than –90 dBc.

25. Change the equipment setup as follows:

a. Set the Low Frequency Spectrum Analyzer controls to the positions:

DOT FREQUENCY	210 kHz
DOT	Centered
FREQUENCY SPAN/DIV	0.1 kHz
RESOLUTION	100

b. Program the UUT for an RF output frequency of 250.210 MHz, a level of 0 dBm, and a frequency step size of 10 MHz. turn off the MODULATION controls.

c. Program the UHF SSG for an RF output frequency of 250.211 MHz, a level of +8 dBm, and a frequency step size of 10 MHz. Turn on the EXT FM/ØM and the DC COUPLED controls.

26. Look at the spurs as follows:

a. Rapidly press and release the Phase Lock Switch until the Oscilloscope indicates that the UUT and the UHF SSG are phase locked.

b. Simultaneously step the UUT and the UHF SSG output frequencies up from 250.210 (250.211 on the UHF SSG) MHz to 510.210 (510.211 on the UHF SSG) MHz while observing the Low Frequency Spectrum Analyzer for spurs (especially at 210 kHz) at every step.

c. Verify that the spurs are less than –90 dBc (the –40 dB line is equivalent to –90 dBc).

NOTE

UHF SSG spurs may be present at 211 kHz. Ignore these spurs.

27. Maintain lock during the remainder of the procedure.

28. Select special function 21 (HI DEV Mode on) on the UUT. Simultaneously step the UUT and the UHF SSG RF frequencies down while looking for spurs as in the previous step. Verify that the spurs are less than –85 dBc.

29. Set the analyzer dot frequency to 840 kHz and select special function 20 (HI DEV Mode off) on the UUT. Simultaneously step up the UUT and the UHF SGG RF output frequencies while observing spurs at 840 kHz as in the previous step. UHF SSG spurs may occur at 844 kHz and should be ignored. Verify that all spurs are less than –90 dBc.

30. Select special function 21 on the UUT and simultaneously step down the UUT and the UHF SSG RF output frequencies while looking for 840 kHz spurs as in the previous step. Verify that all spurs are less than –85 dBc.

31. Repeat Steps 26 through 31 if necessary (around the frequency of interest where spurs just meet specifications) programing a smaller step size (such as 100 kHz) on both the UUT and the UHF SSG. Maintain lock.

32. Change the equipment setup as follows:

a. Set the analyzer setup as follows:

DOT FREQUENCY	400 kHz
Dot	Centered
RESOLUTION (Hz)	100
FREQUENCY SPAN DIV	50

b. Program the UUT for an RF output frequency of 519.6 MHz at a level of +1 dBm and select special function 20. Turn all MODULATION controls off.

c. Program the UHF SSG for an RF output frequency of 519.601 MHz at a level of +8 dBm and select special function 20. Turn on the FM ØM and the DC COUPLED controls.

33. Check for a 400 kHz spur. Verify that the 400 Hz spur is less than -90 dBc (The –50 line is equivalent to –101 dBc.

34. Change the equipment setup as follows:

a. Select special function 31 (fixed range) on the UUT, then program the UUT for an RF output of 62 MHz at a level of 0 dbM.

b. Program the UHF SSG for an RF output frequency of 64.951 MHz.

c. Edit the UUT RF output frequency to 64.95 MHz.

d. Use the Phase Lock Switch to establish phase lock.

35. Verify proper operation in fixed range as follows:

a. Verify that the 400 kHz spur is -90 dBc (the –40 line is the equivalent of –90 dBc).

b. Program the UUT for an RF output level of 0 dBm and repeat this step at the RF output frequencies listed in Table 5-11.

NOTE

At each frequency, establish lock using the Phase Lock Switch.

c. Select special function 30 on the UUT to disable fixed range operation.

Table 5-11. UUT and UHF SSG Frequencies

UUT	LO
57.333333 MHz	57.333000 MHz
51.960000 MHz	51.961000 MHz
47.236354 MHz	47.236000 MHz

5-38. PHASE NOISE CHECK

PURPOSE:	Verify phase noise performance of the UUT.
TEST EQUIPMENT:	Low Frequency spectrum Analyzer, Low Frequency Synthesized Signal Generator (LF SSG), Signal Analyzer, Spur Test System, UHF Signal Generator (UHF SSG)
REMARKS:	1. The noise performance of the UHF SSG must be equal to or better than the noise performance of the UUT because this check measures total noise performance of the UUT, the UHF SSG, and the test setup. 2. The UUT and all test equipment must be a room temperature and must be operating for at least 30 minutes before this check is started.

5-39. Complete the following steps to set up the equipment for the Phase Noise Check.

1. Connect the test equipment as shown in Figure 5-5. Construction of the spur test system is described in the Spurious Output Checks material presented earlier in this section.

2. Set up the equipment as follows:

a. Program the UUT for an RF output frequency of 250 MHz at a level of 0 dBm and for an FM deviation of 19 kHz DEV. Turn on the EXT FM ØMcontrol.

b. Program the UHF SSG for an RF output frequency of 250 MHz at a level of +8 dBm and for an RM of 9 kHz DEV. Turn on the EXT FM ØM and the DC COUPLED controls.

c. Program the LF SSG for an output frequency of 19 kHz at a level of 0.766 mV rms, terminated.

d. Set up the Signal Analyzer as follows:

INPUT	
Ground Selection Switch	ISOL
A COUPLING	Up Position (AC)
CHANNEL A SENSITIVITY	1V
CAL Knob	Calibrated Position
TRIGGER	
LEVEL	FREE RUN
RESETITIVE	In
FREQUENCY	
SPAN	25 kHz
MODE	0 START
MARKER	
ON	In
÷BW	Out
DISPLAY	
AMPLITUDE A	In

SCALE 10 dB/DIV	In
AMPLITUDE REFER-EL	
LEVEL	NORM
PASSBAND SHAPE	HANNING
AVERAGE	
OFF	In
SHIFT	In
NUMBER 256	In

Set all other pushbuttons to the output positions. Adjust INTENSITY, FOCUS, and GRAT. ILLUM for the optimum display.

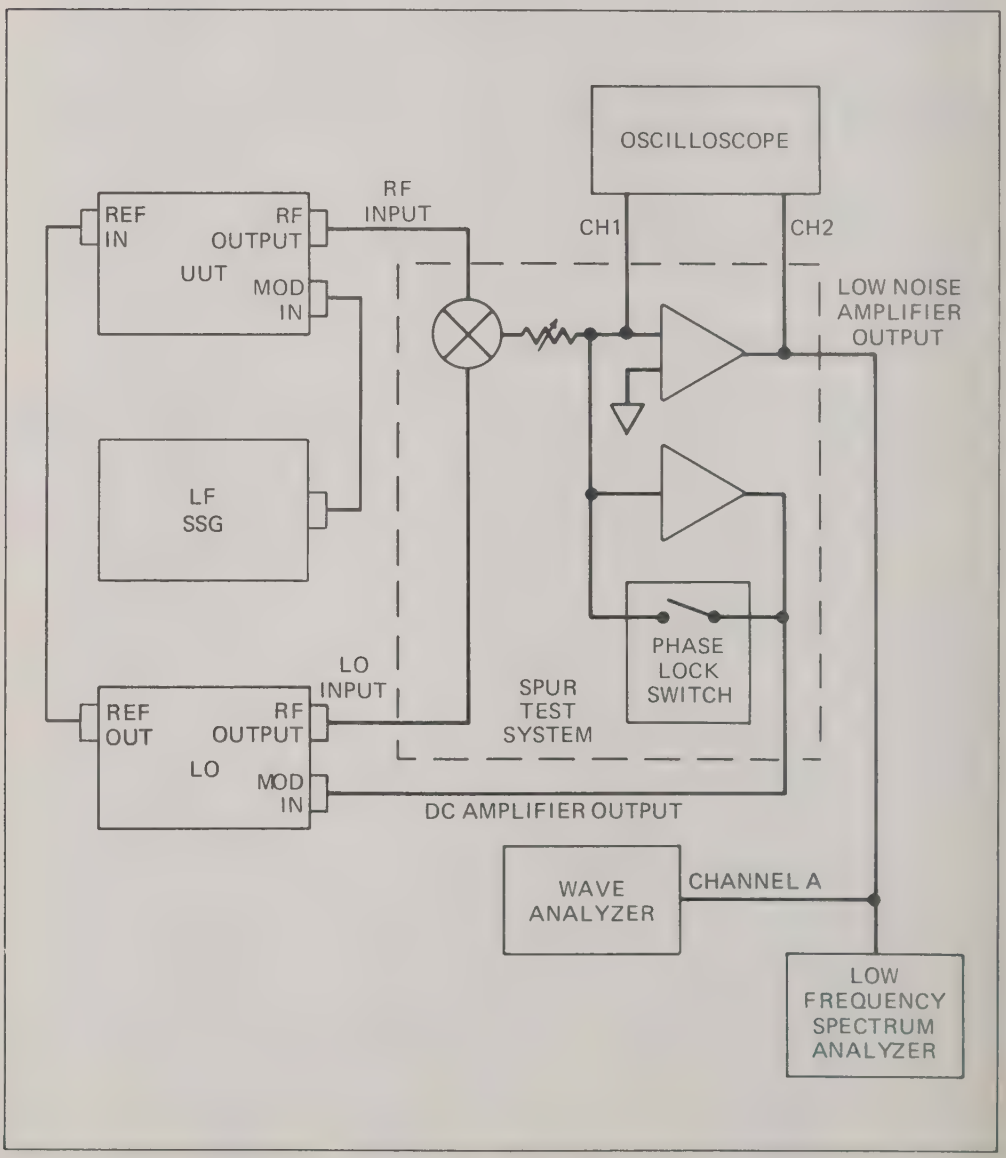


Figure 5-5. Phase Noise Check

f. Set up the Low Frequency Spectrum Analyzer as follows:

Frequency	0
Dot	1 graticule from the left
FREQUENCY SPAN/DIV	5 kHz
TIME/DIV	1 S
Termination	600 ohms
Reference	dBv

g. Rapidly press and release the Phase Lock switch to establish lock.

3. On the Low Frequency Spectrum Analyzer, adjust the dot for 19 kHz signal at one minor division left of center and adjust amplitude so that the 19 kHz signal peak is 1 division from the top.

4. Verify that the waveforms on the oscilloscope and the Low Frequency Spectrum analyzer agree with the waveforms shown in Figure 5-6. These waveforms should remain consistent through the remainder of the check.

5-40. Complete the following steps to verify the phase noise performance of the UUT.

1. Establish the proper phase relationship between the UUT and the UHF SSG RF output frequencies.

a. Turn off the EXT FM/ØM controls on the UUT and the UHF SSG.

b. Disconnect the DC Amplifier output of the spur test system from the MOD IN connector on the UHF SSG.

c. Use the UUT Edit Knob to quickly change the UUT RF output frequency up 1 Hz and back down 1 Hz. Repeat this step until the Channel 1 trace on the oscilloscope is 0V ±10 mV.

d. Turn on the EXT FM/ØM control on the UUT.

2. On the Signal Analyzer, set FREQEUENCY SPAN to 25 kHz, MARKER BW out, press AVERAGE OFF, and adjust Channel A sensitivity for maximum without overloading.

3. Rotate the MARKER POSITION knob so that the marker is on the 19 kHz signal in the display and record the marker reading (upper left corner of the display in dBV).

4. On the UUT, turn off the EXT FM/ØM control.

5. On the Signal Analyzer (SA), rotate the MARKER POSITION knob so that marker frequency is 20 kHz (lower part of the display) and press the MARKER÷ BW control in.

6. Complete the following steps to determine the phase noise.

a. Press the AVERAGE RMS control then the RESTART control.

b. Wait for the TRIGGER DATA LOADING indicator to stop flashing then record the marker reading in dBV/ Hz.

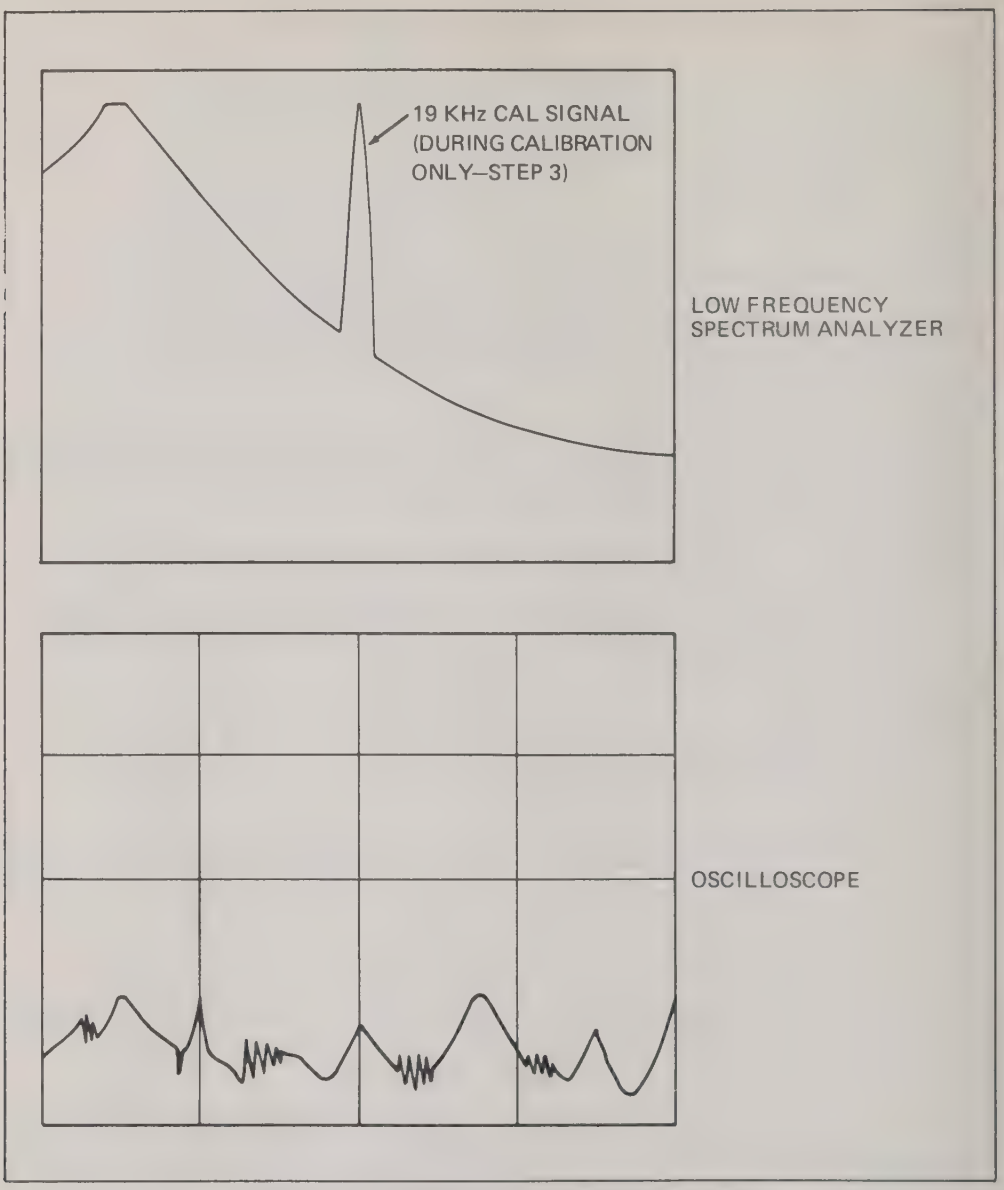


Figure 5-6. Displays During Phase Noise Check

c. Calculate phase noise using the formula:

Phase Noise = Marker Reading From Step 5C - Marker Reading From Step 3 - 60 dB

d. Record the computed value for phase in the appropriate space in Table 5-12 and verify that the values for phase noise is not greater than the indicated limit.

7. On the WA, rotate the MARKER POSITION knob so that marker frequency is 5 kHz.

Table 5-12. Phase Noise Check

UUT AND LO RF OUTPUT FREQUENCIES (MHz)	PHASE NOISE (dBc/Hz)* AT:			
	100 Hz	1 kHz	5 kHz	20 kHz
250 500				
250 AND 500 LIMITS*	-82	-88	-115	-132
800 (6071A ONLY)				
800 LIMITS	-76	-82	-109	-126
50				
50 LIMITS	-75	-85	-107	-123

*This is the total noise of the UUT, the LO, and the test setup. Two sources (UUT and LO) with equal noise performance are each 3 dB better than the values listed.

8. Note the marker reading dBV/HZ. Complete the following steps:

   a. Calculate phase noise using the following formula:

   Phase Noise = Marker Reading Noted in This Step - Marker Reading From Step 3 - 60 dB

   b. Record the computed value for phase noise in the appropriate space in Table 5-12 and verify that the value for phase noise is not greater than the indicated limit.

9. On the WA, set the FREQUENCY SPAN control to 1 kHz. Press the RESTART control and wait for the DATA LOADING complete indication.

10. On the WA, rotate the MARKER POSITION knob so that the marker frequency is 1 kHz.

11. Note the marker reading in dBV/Hz. Complete the following steps:

   a. Calculate phase noise using the following formula:

   Phase Noise = Marker Reading Noted in This Step - Marker Reading From Step 3 - 60 dB

   b. Record the computed value for phase noise in the appropriate space in Table 5-12 and verify that the value for phase noise is not greater than the indicated limit.

12. On the WA, rotate the MARKER POSITION knob so that the marker frequency is 100 Hz.

13. Note the marker reading in dBV/Hz. Complete the following steps:

   a. Calculate phase noise using the following formula:

   Phase Noise = Marker Reading Noted in This Step - Marker Reading From Step 3 - 60 dB

b. Record the computed value for phase noise in the appropriate space in Table 5-12 and verify that the value for phase noise is not greater than the indicated limit.

14. Program the UUT and the UHF SSG RF output frequencies to the values listed in Table 5-12. Repeat the procedure from Step 1 for each RF frequency.

5-41. ANGLE MODULATION PERFORMANCE CHECK

PURPOSE:	Verify performance and calibration of all modulation circuitry.
TEST EQUIPMENT:	Modulation Analyzer, Low Frequency Spectrum Analyzer.
REMARKS:	1. This is a confidence check. A comprehensive check requires software. 2. The UUT and all test equipment must be a room temperature and must be operating for at least 30 minutes before this check is started.

5-42. This angle modulation performance check verifies that all internal modulation circuits are functioning and properly calibrated. A comprehensive performance check of all angle modulation parameters at all frequencies, modulation rates, and depths is beyond the scope of this manual. Such a check requires the use of automated test programs.

5-43. Complete the following steps to verify the performance and calibration of all modulation circuitry.

1. Set up the equipment as follows:

   a. Connect the Modulation Analyzer to the UUT RF OUTPUT connector.

   b. Set the Modulation Analyzer controls as follows:

AUTOMATIC OPERATION	On
MEASUREMENT	FM
DETECTOR	PEAK +
Bandwidth	50 Hz to >200 kHz.

   c. Recall Memory Location 96 (Press RECALL MEMORY and 9 and 6 DATA controls). This memory location contains information peculiar to this particular instrument. This information is collected and stored during the software calibration procedure and, among other data, contains the following:

      1. FREQUENCY Display has the mid-band frequency of 25X.XXXX MHz where X.XXXX can be any combination of decimal digits.

      2. The size of the frequency step is the delta F between consecutive mid-band frequency points.

d. Connect the Low Frequency Spectrum Analyzer to the Modulation output jack on the Modulation Analyzer.

e. Step the UUT RF output frequency down to 250.XXXX. For example, the frequency in step c, part 1 may have been 256.1129 MHz. Step this to 250.1129 MHz.

2. Step frequency up to 519.YYYY MHz (where YYYY is any combination of decimal digits which may or may not be different from XXXX).

a. Verify at each step that the Modulation Analyzer reading is in the range 88 to 112 kHz.

b. Observe harmonics on the Low Frequency Spectrum Analyzer at 20 kHz at 30 kHz. Verify that the level at each point is 38 dB or greater below the level at 10 kHz.

3. Program the UUT for a frequency step size of 20 MHz and forced high deviation operation (special function 21). Verify that the HI DEV MODE indicator turns on.

4. Step frequency down to 259.YYYY MHz (where YYYY are arbitrary digits.

a. Verify at each step that the Modulation Analyzer reading is in the range 88 to 112 kHz.

b. Observe harmonics on the Low Frequency Spectrum Analyzer at 20 kHz and 30 kHz. Verify that the level at each point is 36 dB or greater below the level of 10 kHz.

5. Set up the equipment as follows:

a. Set the Modulation Analyzer bandwidth for the range 50 Hz to 15 kHz.

b. Program the UUT for a frequency step size of 50 MHz, a modulation frequency of 400 Hz, and an RF output frequency of 250 MHz.

6. Step frequency up to 500 MHz. Verify at each step that the Modulation Analyzer reading is in the range 93 to 107 kHz and that harmonics are $>$36 dB below fundamental at 400 Hz.

7. Disable high deviation mode operation (special function 20) and step frequency down to 250 MHz. Verify at each step that the Modulation Analyzer reading is in the range 90 to 110 kHz and that harmonics are $>$ 38 dB below fundamental at 400 Hz.

8. Enable force DCFM operation (special function 11).

9. Step frequency up to 500 MHz. Verify at each step that the Modulation Analyzer reading is in the range 90 to 110 kHz and that harmonics are $>$ 30 db below fundatmental at 400 Hz.

10. Program UUT so that the RF output frequency is 50 MHz. Verify that the Modulation Analyzer reading is in the range 90 to 110 kHz.

11. Program the instrument for forced high deviation mode operation (special function 21). Verify that the Modulation Analyzer reading is in the range 90 to 110 kHz.

12. Disable the forced high deviation and DCFM modes of operation(special functions 10 and 20).

13. Program the instrument so that the RF output frequency is 385 MHz and the ØM deviation is 9.99 radians. Verify that the Modulation analyzer reading is in the range of 3.6 to 4.4 kHz.

14. Program the UUT so that the modulation frequency 3 kHz. Verify that the Modulation Analyzer reading is in the range of 26.4 to 33.6 kHz.

15. Program UUT so that the modulation frequency is 400 Hz.

16. Program the instrument for each of the FM deviations listed in Part A of Table 5-13. For each programmed deviation, verify that the Modulation Analyzer reading is within the appropriate range listed in Part A of the table.

17. Set up the equipment as follows:

a. Set the Mdouation Analyzer bandwidth for the range 50 Hz to >20 kHz.

b. Program the UUT so that the RF output frequency is 100 MHz and modulation frequency is 10 kHz.

18. Program the UUT for each of the FM deviations listed in Part B of Table 5-13. For each programmed deviation, verify that the Modulation analyzer reading is within the appropriate range listed in Part B of the table.

19. Set up the equipment as follows:

a. Set the Modulation Analyzer bandwidth for the range 50 Hz to 15 kHz.

b. Program the UUT for an RF output frequency of 50 MHz, a modulation frequency of 1 kHz, and forced DCFM operation (special function 11).

20. Program the UUT for each of the FM deviations listed in Part C of Table 5-13. For each programmed deviation, verify that the Modulation analyzer reading is within the appropriate range listed in Part C of the table.

21. Program the UUT as follows:

a. Program the UUT to recall memory location 96 and to enable the internal audio output (special function 71).

b. Press the EX FM/ØM MODULATION control so that it is lit.

c. Connect a BNC cable between the MOD OUT and MOD IN connectors.

22. Adjust the UUT MOD OUT know so that the Modulation Analyzer reading is 100 kHz (the MOD OUT knob is nearly at the maximum clockwise position).

23. Set up the equipment as follows:

    a. Program the UUT for a modulation frequency 20 Hz and press the DC COUPLED MODULATION control so that it is lit.

    b. Set the Modulation Analyzer bandwidth for the range <20 Hz to 15 kHz.

24. Verify that the Modulation analyzer reading is in the range of 90 to 110 kHz.

Table 5-13. Angle Modulation Performance Check

FM DEVIATION (kHz DEV)	MODULATION METER READING	
	FROM	TO
PART A		
199	179.1	218.9
100	90	110
50	45	55
20	18	22
10	9	11
5	4.5	5.5
1	0.9	1.1
PART B		
199	175.12	222.88
125	110	135
100	88	112
50	44	56
25	22	28
10	8.8	11.2
5	4.4	5.6
2	1.76	2.24
1	0.88	1.12
PART C		
300	264	336
200	176	224
100	88	112
50	44	56
20	17.6	22.4
10	8.8	11.2
5	4.4	5.6
1	0.88	1.12

5-44. RF OUTPUT LEVEL CHECK

PURPOSE: To verify that the RF output level is within specified limits without the use of a controller.

TEST EQUIPMENT: Power Meter with power sensor calibrated from 5 MHz to 1.1 GHz, VSWR <1.1, +20 dBm to -20 dBm (a calibrated 10 dB pad will be required if the Power Meter has a maximum input level of +10 dBm); RF Voltmeter; JF2904-442905; Y9308; 50 Ohm Coaxial Cable <1 ft., with BNC connectors; Controller or Bus Exerciser (necessary only if Procedure II is performed).

REMARKS:

1. This procedure verifies the output level accuracy within the measurement range of the power meter. Due to the extreme complexity of verifying the level accuracy down to -140 dBm, customers are advised to use the calibration and verification services available at John Fluke Service Centers (listed in Appendix A). Those customers interested in measurement techniques should contact Customer Service Department; John Fluke Mfg. Co., Inc.

2. The test limits listed in the tables take into account the worst case measurement uncertainties due to VSWR interaction of the UUT and the specified power sensor.

3. The UUT and all test equipment must be at room temperature and must be operating for at least 30 minutes before this check is started.

5-45. Introduction

5-46. The RF Output Level Check is performed in two procedures. Procedure I does not use a controller and verifies that the instrument amplitude correction factors are correct for the high level amplifier, the basic detector range, the 6 dB, the 12 dB, and the first 24 dB attenuator pads. Procedure II uses a controller to verify proper operation of the other 24 dB pads that are used when RF output level is programmed below 41.2 dB.

5-47. Procedure I

5-48. Complete the following steps to perform Procedure I:

1. Set up the equipment as follows:

   a. Program the UUT for an RF output frequency of 5 MHz at a level of +7 dBm. Turn off all MODULATION controls, and use the EDIT and DIGIT controls to place the Bright Digit in the 10 kHz position of the FREQUENCY Display.

   b. Connect the equipment as shown in Figure 5-7.

   c. Set the RF Voltmeter controls as follows:

VOLTS/dB	dB
AC/DC	AC
REL/dBm	dBm
dBm REFERENCE	50 Ohm

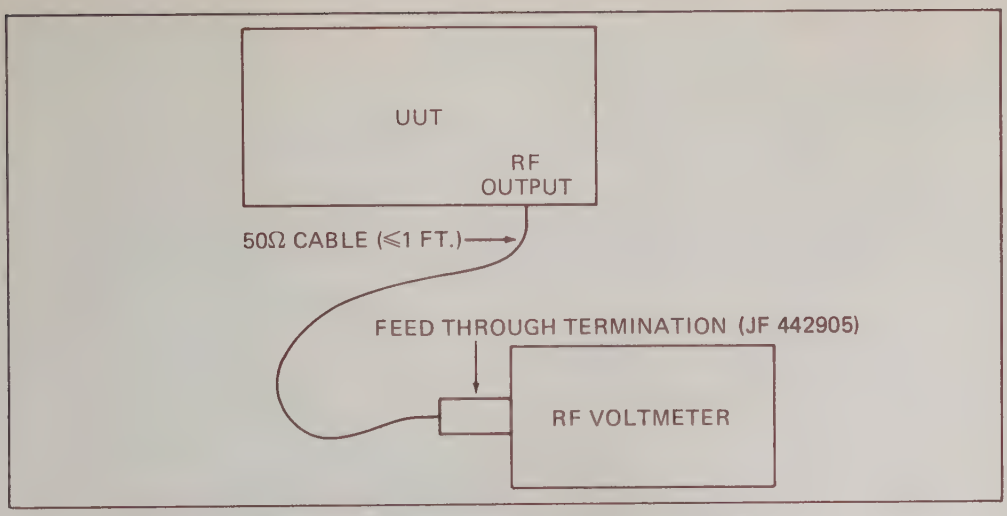


Figure 5-7. RF Output Level Check - Voltmeter

2. Slowly edit frequency from 5 MHz to 0.2 MHz observing the highest and the lowest readings on the RF Voltmeter. Verify that the maximum reading is less than +7.6 dBm (+8.1 dBm with the 607XA-870 Reverse Power Protection Option installed) and that the minimum reading isgreater that +6.4 dBm (+5.9 dBm with the 607XA-870 Option).

3. Program the UUT for the RF output levels listed in Table 5-14. At each level, slowly edit frequency from 0.2 MHz to 5 MHz observing the highest and lowest readings on the RF Voltmeter. Verify that the highest and lowest readings are within the limits listed in Table 5-14.

4. Set up the equipment as follows:

   a. Disconnect the RF Voltmeter and connect the equipment as shown in Figure 5-8.

   b. Program the UUT for an RF output frequency of 5 MHz at a level of +7 dBm. Use the EDIT and DIGIT controls to place the Bright Digit in the 1 MHz position of the FREQUENCY Display.

Table 5-14. Level Checks for Both the 6070A and the 6071A

PROGRAMMED LEVEL (dBm)	RF VOLTMETER OR POWER METER READINGS (dBm)			
	WITHOUT 607XA-870 OPTION		WITH 607XA-870 OPTION	
	THE HIGHEST READING MUST BE LESS THAN	THE LOWEST READING MUST BE GREATER THAN	THE HIGHEST READING MUST BE LESS THAN	THE LOWEST READING MUST BE GREATER THAN
+18	+19.3	+16.7	+19.8	+16.2
+4	+4.7	+3.3	+5.2	+2.8
-1	-0.3	-1.7	-0.2	-2.2
-12	-11.2	-12.8	-10.7	-13.3

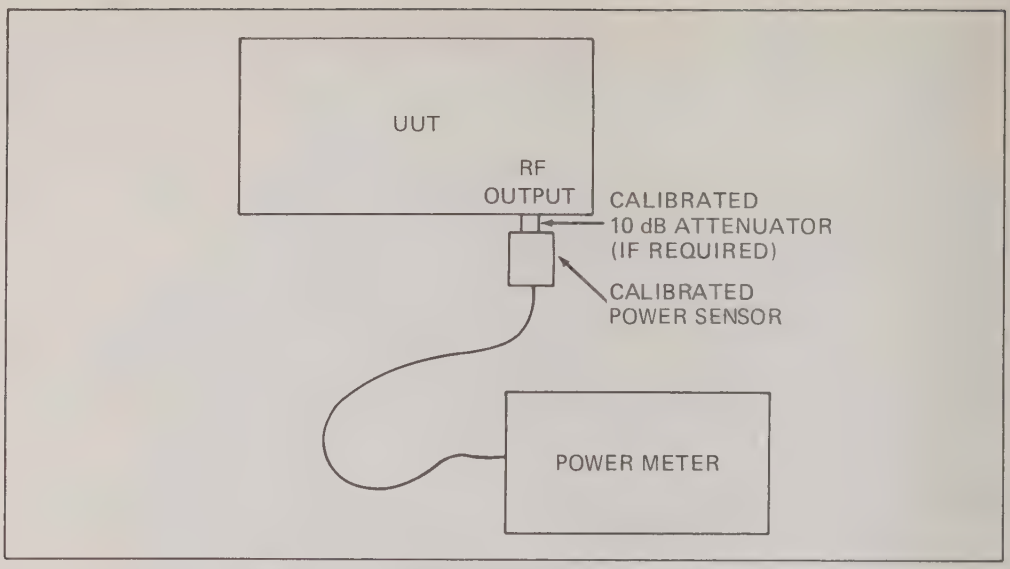


Figure 5-8. RF Output Level Check - Power Meter

5. Slowly edit frequency from 5 MHz to 519 MHz observing the highest and lowest readings on the Power Meter. Verify that the highest reading is less than +7.6 dBm (+8.1 dBm with the 607XA-870 Option installed) and that the lowest reading is greater than +6.4 dBm (+5.9dBm with the 607XA-870 Option installed).

CAUTION

If the power meter does not have a +20 DBM input capability, the RF output of the UUT must be connected through the calibrated 10 dB pad to the power meter input to prevent possible damage to the meter at a level of +18 dBm.

6. Program the UUT for the RF output levels listed in Table 5-14. At each level, slowly edit frequency from 5 MHz to 519 MHz observing the highest and lowest readings on the Power Meter. Verify that the highest and lowest readings are within the limits listed in Table 5-14. Remove the 10 dB pad when measuring levels below +10 dBm to improve Power Meter sensitivity.

7. If the UUT is a 6071A, program the UUT for the output levels listed in Table 5-15. At each level, slowly edit frequency from 520 to 1040 MHz observing the highest and lowest readings on the Power Meter. Verify that the highest and lowest readings are within the limits listed in Table 5-15.

Table 5-15. Level Checks for the 6071A Only

PROGRAMMED LEVEL (dBm)	POWER METER READINGS (dBm)			
	WITHOUT 607XA-870 OPTION		WITH 607XA-870 OPTION	
	THE HIGHEST READING MUST BE LESS THAN	THE LOWEST READING MUST BE GREATER THAN	THE HIGHEST READING MUST BE LESS THAN	THE LOWEST READING MUST BE GREATER THAN
+13	+15.3	+10.7	+15.8	+10.2
+2	+3.4	+0.6	+3.9	+0.1
-2	-0.5	-3.6	-0	-4.1
-8	-6.4	-9.6	-5.9	-10.1
-18	-16.3	-19.7	-15.8	-20.2

5-49. Procedure II

5-50. Complete the following steps to perform Procedure II:

1. Connect the equipment as shown in Figure 6-8 and program the UUT for an RF output frequency of 10 MHz at a level of –17 dBm.

2. Program the Controller or use the Bus Exerciser to send the strings listed in Table 5-16. All message strings enclosed by the symbols <> must be sent as shown. Verify at each setting that the Power Meter reading is within the range of –16.2 to –17.8 dBm.

3. Program the UUT for an RF output frequency of 519 MHz and repeat Step 2.

4. If the UUT is a 6071A, program the UUT for an RF output frequency of 1039 MHz at a level of –18 dBm.

5. Repeat Step 3, but verify that the Power Meter reading is within the range –16.3 to 19.7 dBm for each setting.

Table 5-16. Level Check -- IEEE-488 Messages

ATTENUATOR ENABLED	IEEE-488 MESSAGE
24DB1	〈OD123AT〉
24DB2	〈OD119AT〉
24DB3	〈OD111AT〉
24DB4	〈OD95AT〉
24DB5	〈OD63AT〉

5-51. AM CHECK

PURPOSE: To verify that AM performance is within specified limits.

TEST EQUIPMENT: Modulation Analyzer, Low Frequency Spectrum Analyzer, Low Frequency Synthesized Signal Generator, Systems DMM

REMARKS: The UUT and all test equipment must be at room temperature and must be operating for at least 30 minutes before this check is started.

5-52. Perform the following steps to complete the AM Check:

1. Perform the AM calibration on the Modulation Analyzer using the internal calibrator as follows:

   a. Connect the calibrator output of the Modulaton Analyzer to the RF input of the Modulaton Analyzer.

   b. Press AM, +PEAK, CALIBRATION and wait for one minute.

   c. Press 16.1, SPCL to enable application of the internal calibration factor.

d. Remove the connection between the modulation Analyzer calibrator output and RF input.

2. Set up the equipment as follows:

a. Connect the UUT RF OUTPUT to the Modulation Analyzer input.

b. Connect the output of the LF Synthesized Signal Generator (LFSSG) to the UUT MOD IN connector through a BNC Tee. Connect the input of the systems DMM to the other arm of the BNC Tee.

c. Connect the MODULATION OUTPUT of the Modulation Analyzer to the input of the Spectrum Analyzer.

d. Program the UUT for an RF output frequency of 0.2 MHz, a level of 13 dBm, and an AM depth of 90%. Turn on the EXT AM control.

e. Program the LFSSG for an input to the UUT MOD IN connector of 1 kHz at a level of 0.7071V rms as measured by the System DMM.

f. Set up the Spectrum Analyzer to display the 1 kHz modulation signal to full scale with sufficient span to include at least three harmonics.

3. Allow Modulation Analyzer to settle and record the reading.

4. Press -PEAK on the Modulation analyzer. Wait for the Modulation Analyzer to settle and record the reading.

5. Calculate the average AM by dividing the sum of the +PEAK and the -PEAK readings by 2. Verify that the average AM is greater than 82% but less than 95%.

6. Verify that the level of the harmonics on the Spectrum Analyzer are less than -26 dB with respect to the level of the fundamental modulation signal.

NOTE

Since AM distortion is specified as total harmonic distortion, the effect of all harmonics should be included. If there is one dominant harmonic component (more than 6 dB larger than any other harmonic components), then there is only a small error (< 1 dB) in ignoring the other harmonic components. The test limit for the dominant harmonic is shown in Table 5-17. If there is not one dominant harmonic component, then the second through the fourth harmonic should be measured to determine the total harmonic distortion. Use the following formula to determine the total harmonic distortion (this formula includes the contribution of all harmonics).

$$THD_{dB} = 10 \log_{10} [10^{(\frac{H2}{10})} + 10^{(\frac{H3}{10})} + 10^{(\frac{H4}{10})} ... + 10^{(\frac{Hn}{10})}]$$

Where: H2, H3, H4, etc. are the levels (in dB) of each harmonic with respect to the fundamental as measured on the Low Frequency Spectrum Analyzer.

7. Program the combinations of UUT RF output frequency, level, and AM depth listed in Table 5-17. For each step, verify that the average AM is between the indicated limits and that the level of any harmonics is less than the listed limit (with respect to the level of the fundamental modulation signal).

Table 5-17. 6070A/6071A AM Level Check -- 1kHz Modulation

UUT			AVERAGED AM (%)		MAXIMUM HARMONIC LEVEL (dB) WITH RESPECT TO THE LEVEL OF THE FUNDAMENTAL MODULATION SIGNAL
FREQUENCY (MHz)	LEVEL (dBm)	AM (%)	MAX.	MIN.	
0.2	+13	90	95	82	-23
		70	75	62	-26
		30	35	22	-34
	+1	90	95	82	-23
		70	75	62	-26
		30	35	22	-34
4.999	+13	90	95	82	-23
		70	75	62	-26
		30	35	22	-34
	+1	90	95	82	-23
		70	75	62	-26
		30	35	22	-34

8. Program the LF SSG for an input of 3 kHz to the UUT MOD IN connector and set the Spectrum Analyzer to include the fundamental and at least three harmonics.

9. Program the combinations of UUT RF output frequency, level, and AM depth listed in Table 5-18. for each step, verify that the average AM is between the indicated limits and that the level of any harmonic is less than the listed limit (with respect to the level of the fundamental modulation signal).

Table 5-18. 6070A/6071A AM Level Check -- 3 kHz Modulation

UUT			AVERAGED AM (%)		MAXIMUM HARMONIC LEVEL (dB) WITH RESPECT TO THE LEVEL OF THE FUNDAMENTAL MODULATION SIGNAL
FREQUENCY (MHz)	LEVEL (dBm)	AM (%)	MAX.	MIN.	
5	+13	90	95	85	-30
		30	35	25	-36
	+1	90	95	85	-30
		30	35	25	-36
30	+13	90	95	85	-30
		30	35	25	-36
	+1	90	95	85	-30
		30	35	25	-36
100	+13	90	95	85	-30
		30	35	25	-36
	+1	90	95	85	-30
		30	35	25	-36
300	+13	90	95	85	-30
		30	35	25	-36
	+1	90	95	85	-30
		30	35	25	-36
519	+13	90	95	85	-30
		30	35	25	-36
	+1	90	95	85	-30
		30	35	25	-36

10. If the UUT is a 6071A, program the combination of UUT RF output frequency, level, and AM depth listed in Table 5-19. For each step, verify that the average AM is between the indicated limits and that the level of any harmonic is less than the listed limit (with respect to the level of the fundamental modulation signal).

Table 5-19. 6071A Only AM Level Check -- 3 kHz Modulation

UUT			AVERAGED AM (%)		MAXIMUM HARMONIC LEVEL (dB) WITH RESPECT TO THE LEVEL OF THE FUNDAMENTAL MODULATION SIGNAL
FREQUENCY (MHz)	LEVEL (dBm)	AM (%)	MAX.	MIN.	
550	+7	90	95	85	-26
		70	75	65	-30
		30	35	25	-34
	-5	90	95	85	-26
		70	75	65	-30
		30	35	25	-34
1039	+7	90	95	85	-26
		70	75	65	-30
		30	35	25	-34
	-5	90	95	85	-26
		70	75	65	-30
		30	35	25	-34

5-53. IEEE-488 CHECK

PURPOSE: To test for proper operation of the IEEE-488 bus.

TEST EQUIPMENT: Controller or Bus Exerciser

REMARKS:

1. The commands sent to the UUT exercise most of the instrument's IEEE-488 functions.

2. The UUT and all test equipment must be at room temperature and must be operating for at least 30 minutes before this check is started.

5-54. To test the IEEE-488 bus, program the controller or bus exercise to complete each step of the flow diagram shown in Figure 5-9.

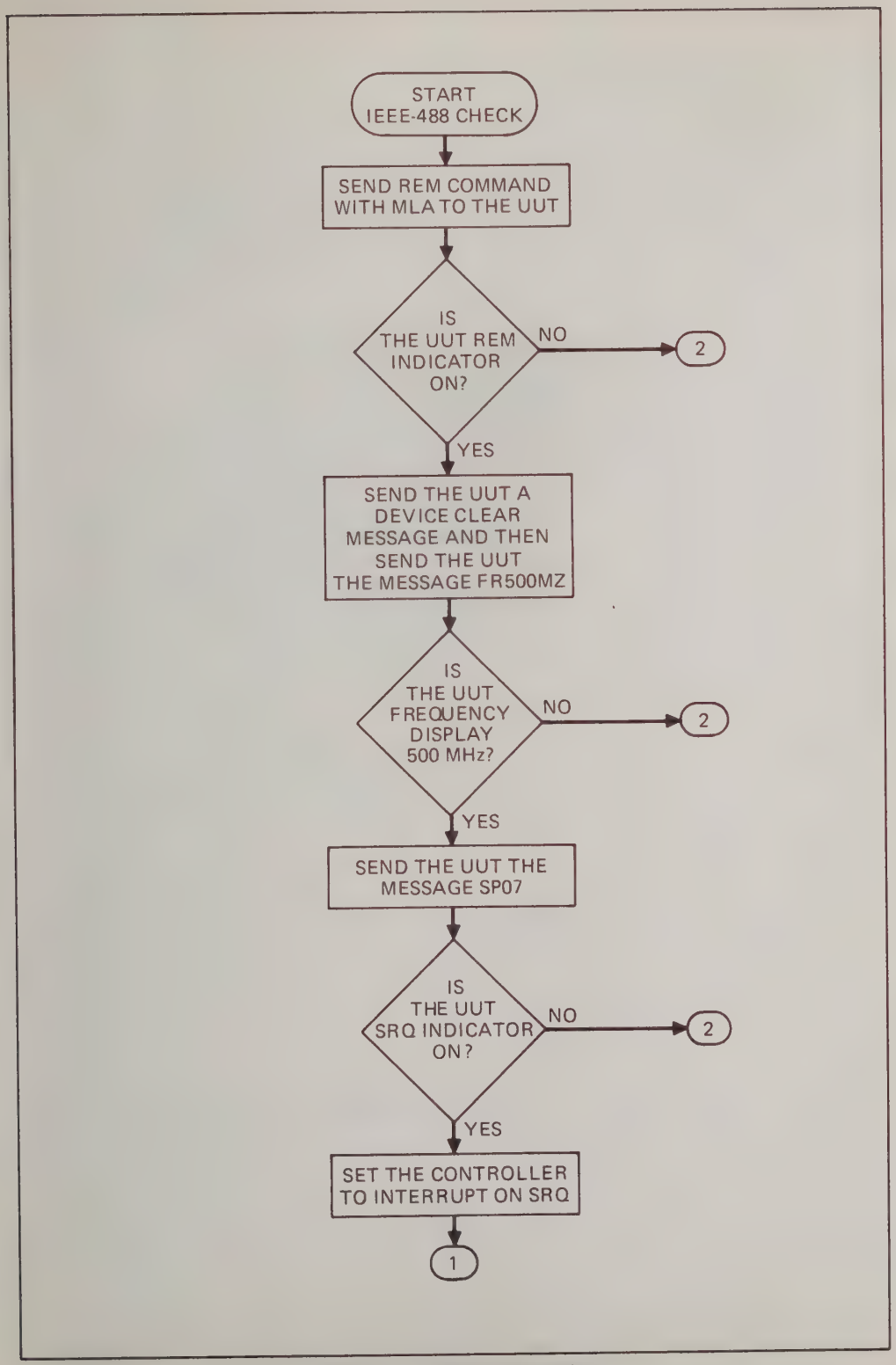


Figure 5-9. IEEE-488 Check

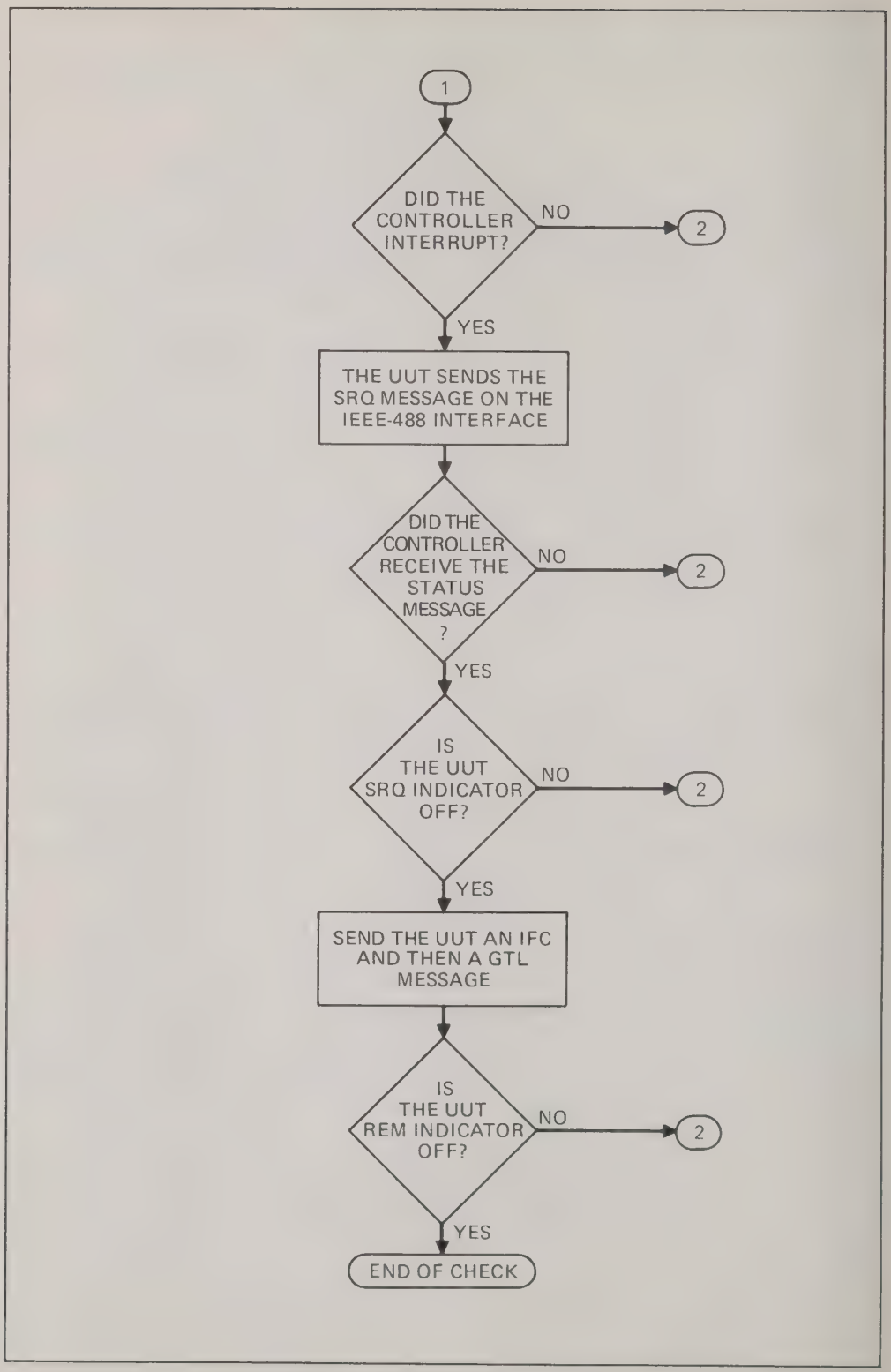


Figure 5-9. IEEE-488 Check (cont)

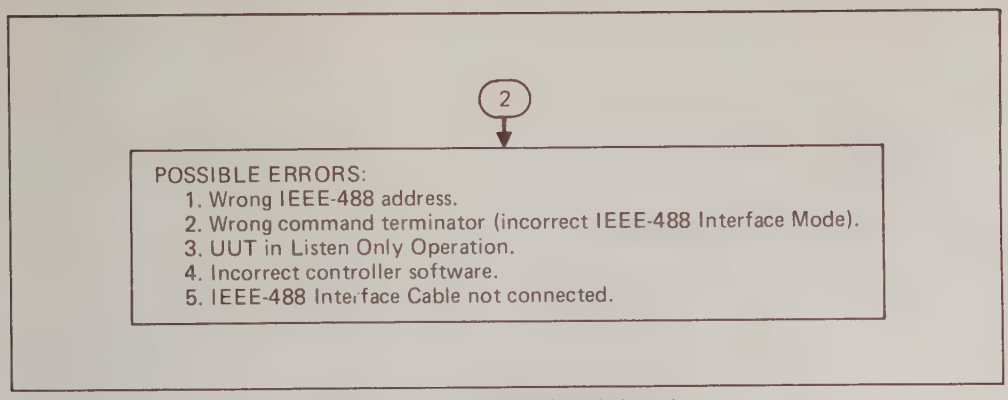

2
POSSIBLE ERRORS:
1. Wrong IEEE-488 address.
2. Wrong command terminator (incorrect IEEE-488 Interface Mode).
3. UUT in Listen Only Operation.
4. Incorrect controller software.
5. IEEE-488 Interface Cable not connected.

Figure 5-9. IEEE-488 Check (cont)

Section 6
Adjustment Procedures

6-1. INTRODUCTION

6-2. The information in this section describes Programming The Calibration EPROM and the Manual Adjustment Procedure. Normally the internal Calibration EPROM has to be reprogrammed only when the instrument fails certain performance checks or when certain components are adjusted, replaced, or repaired. Components that can be adjusted according to manual procedures that do not require specialized test equipment are listed in Table 6-1. The Manual Adjustment Procedure describes the adjustment of these components.

6-3. PROGRAMMING THE CALIBRATION EPROM

6-4. An internal microprocessor correction technique applied to the output signal amplitude and angle modulation provides high accuracy with economical circuitry. However, this design approach requires that each generator be characterized during manufacture or whenever repairs or adjustments are made which affect the characterized parameters.

6-5. The generators are characterized in five general steps:

1. The internal microprocessor corrections are disabled.

2. Generator performance is measured very accurately at a large number of points.

3. The measurement data is converted into correction factors.

4. The correction factors are programmed into a new Calibration EPROM.

5. The Calibration EPROM inside the generator is replaced with the Calibration EPROM programmed in Step 4.

6-6. Because of the large amount of data involved, the only practical procedure for characterizing the generator, for converting the data, and for reprogramming the Calibration EPROM requires the use of an external controller, the appropriate software, and other equipment. This procedure is not presented in this manual. Instead, the user is urged to return the generator to the nearest John Fluke Service Center when Calibration EPROM programming the Calibration EPROM at their facility should contact the Customer Service Department of John Fluke Mfg. Co., Inc.; P.O. Box 43210; Mountlake Terrace, WA 98043; telephone (206) 77402211; for addition information.

6-7. MANUAL ADJUSTMENT PROCEDURES

6-8. Introduction

6-9. The information in this section describes procedures for completing those

adjustments that can be made without requiring that the Calibration EPROM be reprogrammed. There are four manual adjustment procedures:

1. Power Supply Adjustment Procedures
2. FM/ØM Adjustment Procedure
3. AM And Level Adjustment Procedure
4. 10 MHz Reference Oscillator Frequency Adjustment

Table 6-1. Manual Adjustments

ASSEMBLY	DEVICE	USE
A3A1 Phase Detector PCB	R4	High-rate, FM/ØM Deviation
	R5	High-rate, FM/ØM Balance
	R10	Low-rate, FM Deviation
	R12	Low-rate, ØM Deviation
A3A2 10 MHz Reference PCB	C9	Crystal Oscillator Frequency
A3A3 Discriminator PCB	R53	Not HI DEV Mode: Low-rate, 99.9 kHz Deviation
	R67	Not HI DEV Mode: Low-rate, 199 kHz Deviation
	R103	HI DEV Mode: High-rate Deviation
A3A9 Synth Distribution PCB	R10	Overall Deviation Calibration
A4A2 Mod Oscillator PCB	R6	Mod Oscillator Level
A4A5 RPP PCB (607XA-870 Option see Section 7C for adjustment procedure)	R7	RPP Trip Level
A4A6 X2/Output Amplifier PCB (6071A only)	R29	>5 MHz Detector Offset
	R37	<5 MHz Detector Offset
	R53	U15 Input Offset Zero
A4A7 Output Amplifier PCB (6070A only)	R4	>5 MHz Detector Offset
	R6	<5 MHz Detector Offset
	R9	U4 Input Offset Zero
A4A10 Mod Distribution PCB	R22	AM Calibration
	R30	DCFM Mode: High-rate Deviation
	R33	DCFM Mode: High-rate, 500 kHz Deviation
	R48	DCFM Mode: Low-rate Deviation
	R55	Output Level Calibration
607XA-130 Option (See Section 7A for adjustments procedure)	COARSE	Coarse Frequency
	FINE	Fine Frequency

6-10. Power Supply Adjustment Procedure

WARNING

LIFE HAZARD VOLTAGES ARE PRESENT IN THE POWER SUPPLY WHEN THE INSTRUMENT IS DISASSEMBLED FOR THIS PROCEDURE. USE RECOGNIZED SAFETY PRACTICES AT ALL TIMES.

PURPOSE:

1. Check all power supply voltages.
2. Adjust the power supply frequency.
3. Adjust the output voltage of the switching power supply.
4. Adjust the output voltage of the series pass regulator.

TEST EQUIPMENT: Oscilloscope or Frequency Counter, System DMM

REMARKS:

1. The following procedure assumes that the UUT is connected to line power, that the POWER control is at the STBY position, and that the MAIN POWER switch is set to OFF.
2. The UUT and all test equipment must be at room temperature and must be operating for at least 30 minutes before this procedure is started.

6-11. Complete the following steps to adjust the power supply.

1. Complete the disassembly portions of the Interior Access Procedure and the Power Supply Access Procedure in Section 3.

2. Verify proper operation of the auxiliary power supply as follows:

   a. Connect the DVM to the A6A2 Series Pass Motherboard : LO input to TP7 and HI input to J6-15 (Figure 6-1).

   b. Set the MAIN POWER switch to the ON position and verify that the DVM display is between 18.5 and 24.0V dc.

   c. Set the POWER control to the ON position and verify that the DVM display drops to 0V dc.

3. Set the switching frequency as follows:

   a. Connect the oscilloscope or the frequency counter to pin 11 or pin 13 of U1 on the A5A2 P/S Regulator PCB (Figure 6-2).

   b. Adjust R1 on the A5A2 Regulator PCB until either the period of the waveform on the oscilloscope is 20 usec or the frequency counter displays 50 kHz.

4. Adjust and verify the output voltages of the switching power supply as follows:

   a. Connect the DVM across C17 on the A5A1 Power Supply PCB (Figure 6-3).

b. Adjust R7 on the A5A2 Regulator PCB (Figure 6-2) so that the DVM display is between 5.94 and 5.96V dc.

c. Connect the DVM across the pins of J7 on the A5A1 Power Supply PCB (Figure 6-3) listed in Table 6-2. Verify that the voltage displayed on the DVM is within the indicated limits for each measurement.

5. Adjust and verify the output voltages of the Series Pass Regulator as follows:

a. On the A6A2 Series Pass Motherboard, connect the DVM: HI to TP6 and LO to TP7.

b. Adjust R5 on the A6A4 +24V, +12V Series Pass Regulator PCB (Figure 6-4) so that the DVM display is between 23.997 and 24.003 mV dc.

c. Leave the LO input of the DVM connected to TP7 and connect the + input of the DVM to the test points listed in Table 6-3. Verify that the DVM display is within the indicated limits for each measurement.

6. Disconnect all test equipment. Assemble the instrument using the assembly portions of the Interior Access Procedure and the Power Supply Access Procedure in Section 3.

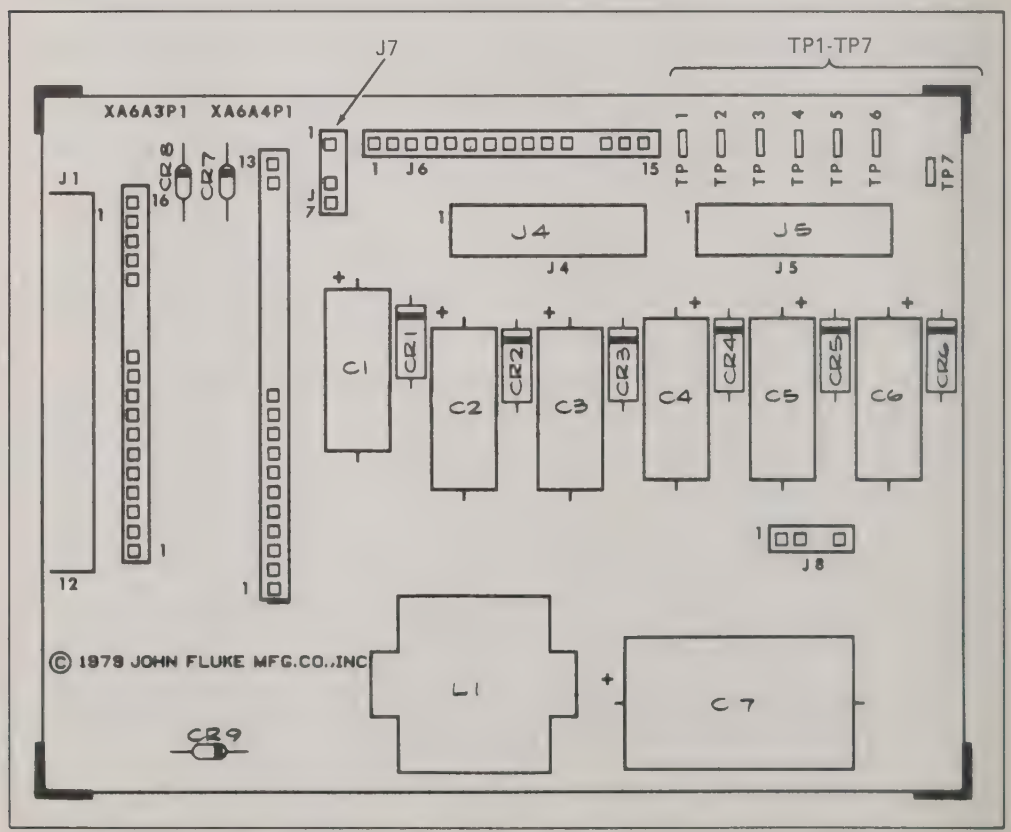


Figure 6-1. A6A2 Series Pass Motherboard PCB

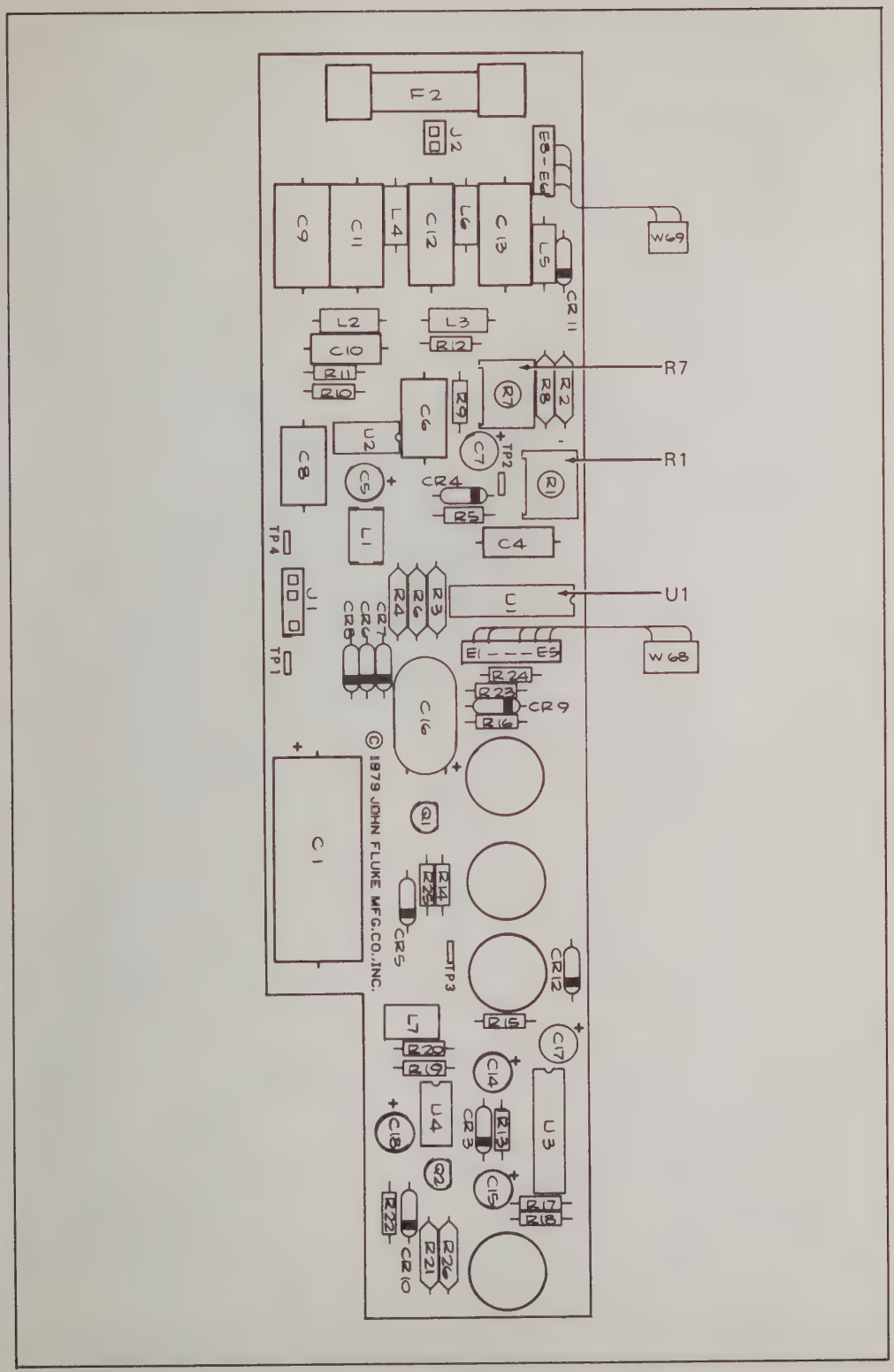


Figure 6-2. A5A2 P/S Regulator PCB

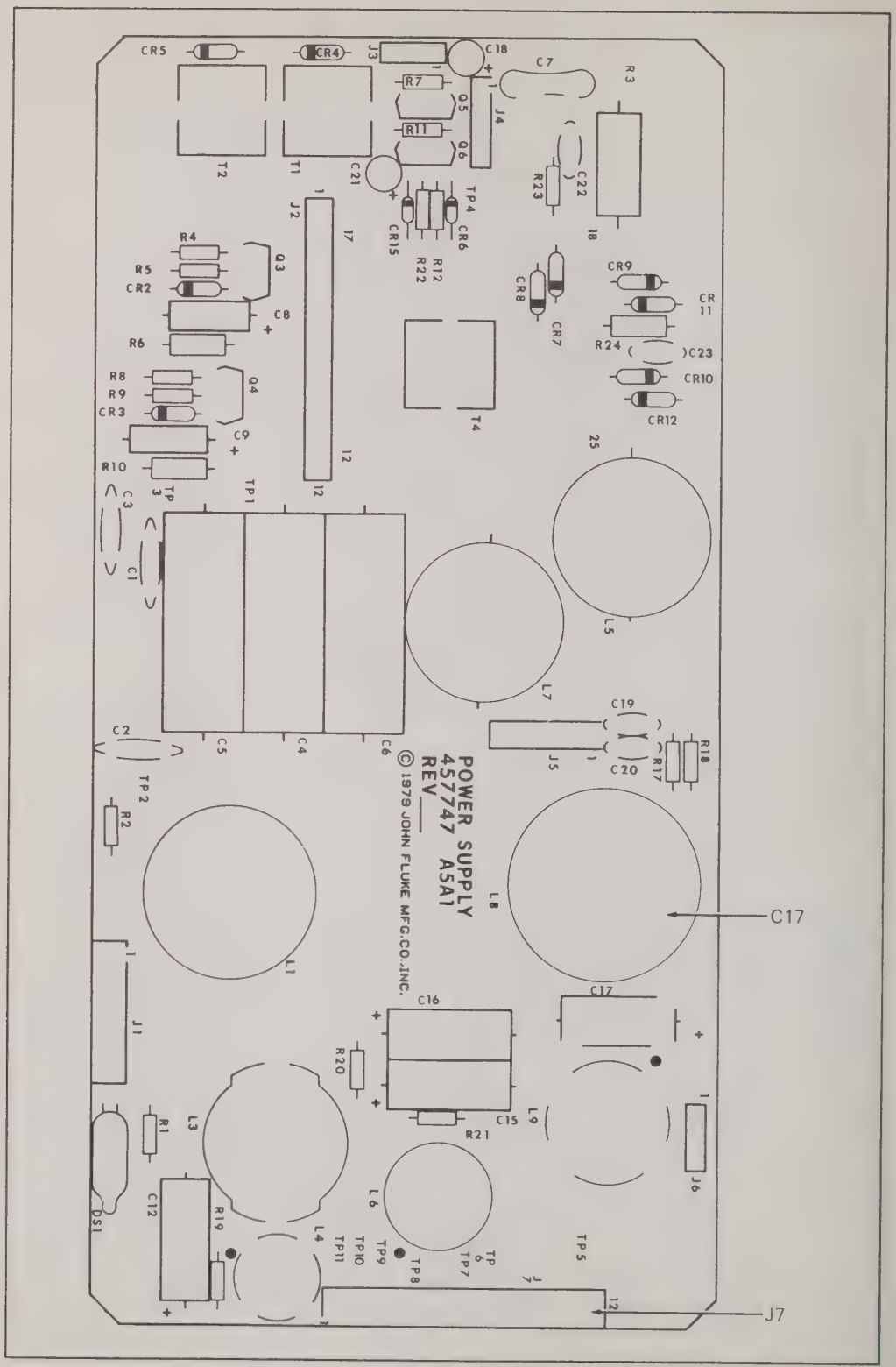


Figure 6-3. A5A1 Power Supply PCB

Table 6-2. Switching Power Supply Voltage Limits

CONNECT THE DVM		LIMITS in V dc	
HI to J7, pin	LO to J7, pin	MINIMUM	MAXIMUM
11	8	5.85	5.94
4	5	13.00	13.65
6	5	-13.00	-13.90
1	2	24.80	25.95

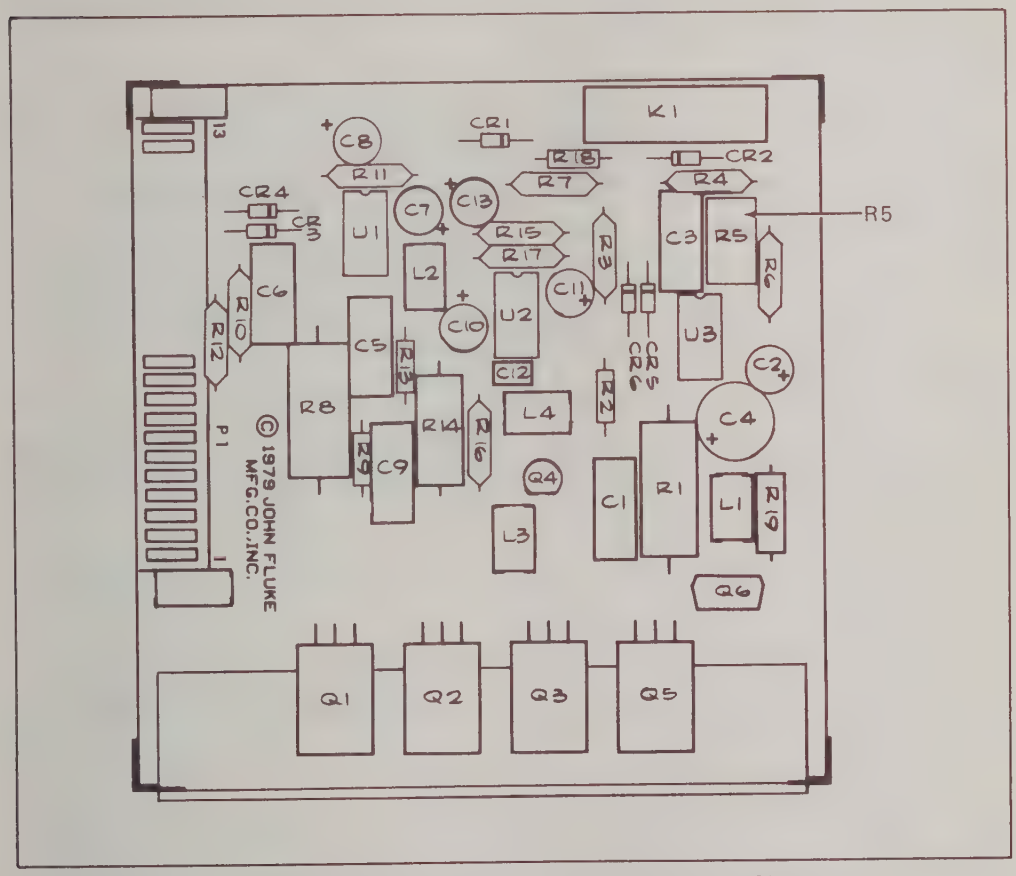


Figure 6-4. A6A4 +12, -12, +24V Series Pass PCB

Table 6-3. +12, -12, +24V Series Pass Regulator Voltage Limits

CONNECT THE DVM INPUT TO	LIMITS IN DC VOLTS	
	MIMINUM	MAXIMUM
TP1	5.090	5.141
TP2	5.090	5.141
TP3	5.090	5.141
TP4	11.975	12.012
TP5	-11.954	-12.036

6-12. FM/ØM Adjustment Procedures

PURPOSE:	Provide adjustment of the FM/ØM modulation circuitry.
TEST EQUIPMENT:	Low Frequency Synthesized Signal Generator, Modulation Analyzer, RMSVoltmeter, BNC Tee Connector, Oscilloscope (Oscilloscope is for Procedure II only)
REMARKS:	1. There are two FM/ØM adjustment procedures. The first procedure is used for normal calibration and maintenance. The second procedure is used if certain criteria of the first procedure are not met. Perform the second procedure only when necessary. 2. The UUT and all test equipment must be at room temperature and must be operating for at least 30 minutes before this procedure is started.

6-13. PROCEDURE I

6-14. Complete the following steps to perform Procedure I:

1. Insure that the instrument has been warmed up for a minimum of 2 hours with all covers in place before starting this procedure.

2. Set up the equipment as follows:

   a. Connect the Low Frequency Synthesized Signal Generator output to the UUT MOD IN connector through a BNC tee. Connect the RMS Voltmeter input to the other arm of the BNC tee.

   b. Connect the UUT RF OUTPUT connector to the Modulation analyzer input.

   c. Set the RMS Voltmeter dB/VOLTS control to the VOLTS position.

   d. Program the Modulation Analyzer to AUTO, FM, 50 Hz HP Filter, and PEAK +.

   e. Program the Low Frequency Synthesized Signal Generator for an output of 10 kHz at a level of 141.6 mV rms as measured on the RMS Voltmeter.

   f. Program the UUT for an RF output frequency of 50 MHz, a level of +7 dBm, and an FM deviation of 499 kHz. Turn on the EXT FM/ØM and the DC COUPLED controls.

3. Remove the outer covers from the UUT using the disassembly portion of the Interior Access procedure in Section 3. Do not remove any module covers.

4. Adjust R33 on the A4A10 Mod Distribution PCB (Figure 6-5) for a reading of 100.1 kHz on the Modulation Analyzer.

5. Program the Low Frequency Synthesized Signal Generator for an output level of 707.1 mV rms as read on the RMS voltmeter. Program the UUT FM deviation to 99.9 kHz.

Figure 6-5. FM/ØM Adjustments - Output Plate

6. Adjust R31 on the Mod Distribution PCB (Figure 6-5) for a reading of 100.1 kHz on the Modulation Analyzer.

7. Program the UUT to RECALL 96 and turn on the EXT FM/ØM control.

8. Program a new frequency step size as follows:

a. Press SHIFT, FREQ STEP. Frequency step size appears in the FREQUENCY Display (typically, 1.0XXX MHz).

b. Program a new frequency step size that is equal to 4 times the value displayed in Step a.

9. Step the UUT RF output frequency up as close to 385 MHz as possible.

10. Complete the following steps to determine if it is necessary to perform procedure II:

a. Record the Modulation Analyzer reading (typically 100 kHz).

b. Select special function 21 on the UUT and record the Modulation Analyzer reading.

c. Program the Low Frequency Synthesized Signal Generator for an output of 400 Hz and record the Modulation Analyzer reading.

d. Select special function 20 on the UUT and record the Modulation Analyzer reading.

e. Program the UUT for phase modulation of 9.99 radians and enable the 3 kHz LPF on the Modulation Analyzer. Record the Modulation Analyzer reading.

f. Select special function 21 on the UUT and record the Modulation Analyzer reading.

g. Criteria for the Modulation Analyzer readings collected in Steps a through f follow. Go to Step 11 if the readings meet the criteria. Go to Procedure II if the readings do not meet the criteria.

1. The readings recorded in Steps a and c must be equal to the reading recorded in Step b ±2%.

2. The reading recorded in Step d must be equal to the reading recorded in Step b +3%, -1%.

3. The readings recorded in Steps e and f must be 4.00 ±0.1 kHz.

11. Program the Low Frequency Synthesized Signal Generator for an output of 10 kHz and set the Modulation Analyzer BW to >200 kHz. Program the UUT for an FM deviation of 99.9 kHz and turn on the EXT FM/ØM control.

12. Adjust R10 on the A3A9 Synthesizer Distribution PCB (Figure 6-6) for a Modulation Analyzer reading of 100.1 kHz.

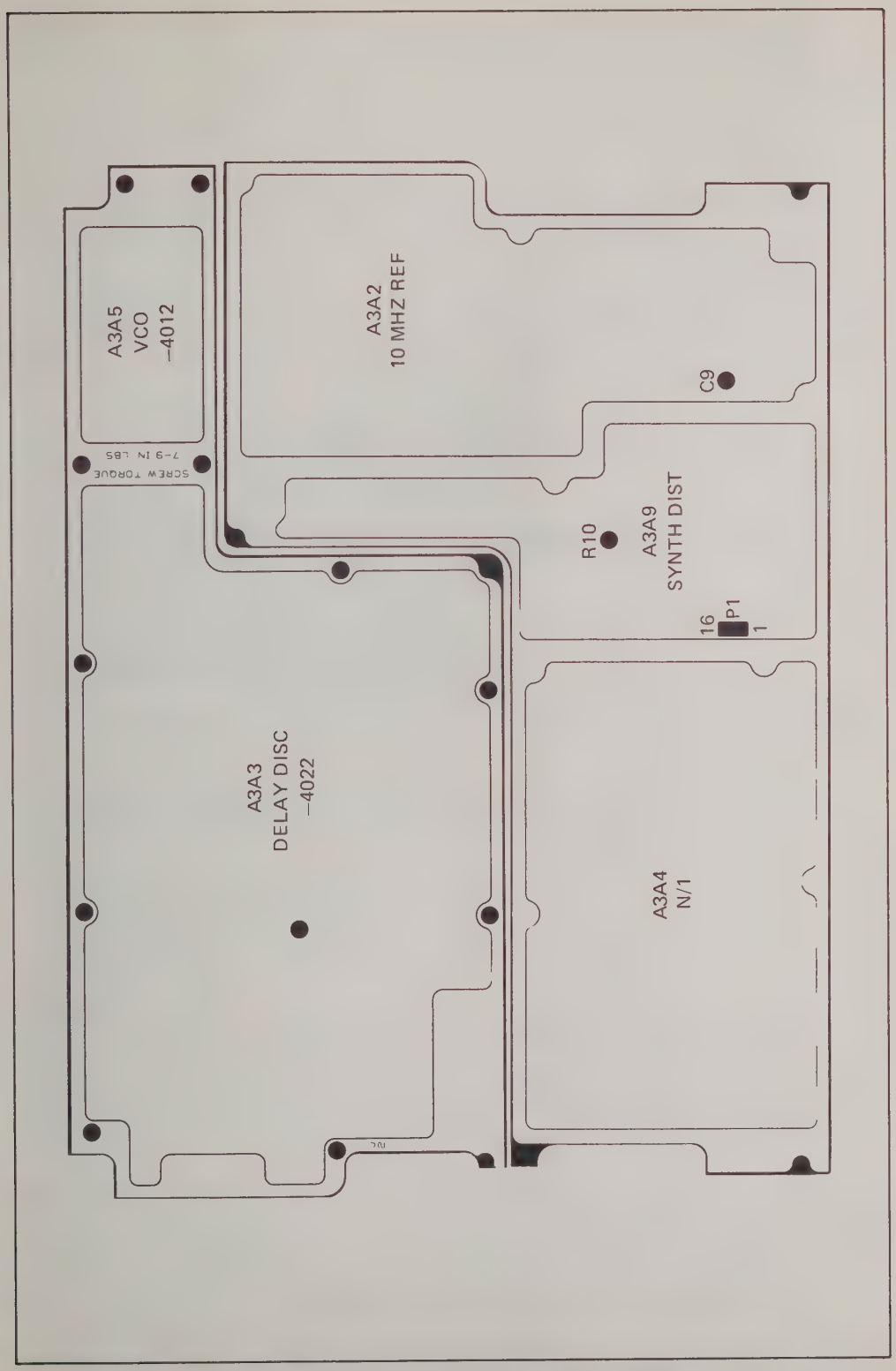


Figure 6-6. FM/ØM Adjustments - Synthesizer Plate

13. Program the Low Frequency Synthesized Signal Generator for an output of 400 Hz and turn on the DC COUPLED control on the UUT. Record the Modulation Analyzer reading.

14. Select special function 20 on the UUT and record the Modulation Analyzer reading.

15. Adjust R48 on the Mod Distribution PCB (Figure 6-5) so tht the readings in Steps 13 and 14 are symmetrical about 100.1 kHz. (It will be necessary to shift in and out of the HI DEV Mode (special functions 20 and 21) in order to make this adjustment).

16. Program the Low Frequency Synthesized Signal Generator for an output of 1 kHz. Select special function 20 on the UUT and turn off the DC COUPLED control. Record the Modulation analyzer reading.

17. Program the UUT Modulation Frequency to 1 kHz and turn on the INT FM/ØM control. Adjust R6 on the A4A2 Mod Oscillator PCB (Figure 6-5) so that the Modulation Analyzer reading is the same as the reading recorded in Step 16.

18. Disconnect all test equipment from the UUT. Assemble the UUT using the assembly portion of the Interior Access procedure in Section 3.

6-15. PROCEDURE II

6-16. If the UUT failed to meet the criteria in Procedure I, complete the following steps:

1. Insure that the instrument has been warmed up for a minimum of 2 hours with all covers in place before starting this procedure.

2. Set up the equipment as follows:

a. Connect the Low Frequency Synthesized Signal Generator output to the UUT MOD IN connector through a BNC Tee. Connect the RMS Voltmeter input to the other arm of the BNC Tee.

b. Connect the UUT RF OUTPUT connnector to the Modulation Analyzer input.

c. Set the RMS Voltmeter dB/VOLTS control to the VOLTS position.

d. Program the Modulation Analyzer to AUTO, FM, bandwidth of 50 Hz to >200 kHz, and PEAK+.

e. Program the Low Frequency Synthesized signal Generator for an input to the MOD IN connector of 10 kHz at a level of 707.1 mV rms as read on the RMS Voltmeter.

f. Program the UUT for RECALL 96 and turn on the EXT FM/ØM control.

3. Program a new frequency step size as follows:

a. Press SHIFT, FREQ STEP. Frequency step size appears in the FREQUENCY Display (typically 1.0XXX MHz).

b. Program the new frequency step size that is equal to 4 times the value displayed in Step a.

4. Step the UUT RF output frequency up as close to 385 MHz as possible.

5. Remove the outer covers from the UUT using the disassembly portion of the Interior Access Procedure in Section 3.

6. Program the UUT for a phase modulation index of 9.99 radians.

7. Adjust R10 on the A3A9 Synthesizer Distribution PCB (Figure 6-6) for a Modulation analyzer reading of 92.7 kHz.

8. Use the disassembly portion of the A3A1 Phase Detector PCB Access procedure in Section 3 to swing out the Synthesizer Plate and to access the Phase Detector compartment. Turn on the UUT and return the UUT to the setup that existed in Step 7.

9. Program the UUT for an FM deviation of 99.9 kHz.

10. Adjust R5 on the A3A1 Phase Detector PCB (Figure 6-7) for a Modulatoin Analyzer reading of 100.1 kHz.

11. Use the disassembly portion of the A3A3 Delay Discriminator PCB Access Procedure in Section 3 to remove that cover to the Discriminator Compartment.

12. On the UUT, select special function 21.

13. Adjust R103 on the A3A3 Delay Discriminator PCB (Figure 6-8) for a Modulation Analyzer reading of 100.1 kHz.

14. Program the Low Frequency Synthesized Signal Generator for an output of 400 Hz.

15. Adjust R10 on the A3A1 Phase Detector PCB (Figure 6-7) for a Modulation Analyzer reading 100.1 kHz.

16. Program the UUT for a phase modulation index of 9.99 radians and enable the 3 kHz low pass filter on the Modulation Analyzer.

17. Adjust R12 on the A3A1 Phase Detector PCB (Figure 6-7) for a Modulation Analyzer reading of 4.0 kHz.

18. Program the Low Frequency Synthesized Signal Generator for level of 353.6 mV rms at the UUT MOD IN connector as read on the RMS Voltmeter.

19. Set the Modulation Analyzer BW to 50 Hz to >200 kHz.

20. Program the UUT for an FM deviation of 199 kHz and select special function 20.

21. Connect the oscilloscope to TP2 on the A3A3 Delay Discriminator PCB (Figure 6-8) and adjust R67 for a Modulation Analyzer reading of 100.1 kHz. If the signal on TP2 is greater than 0.7V peak-to-peak, adjust R67 until the signal at TP2 is 0.7V peak-to-peak. Verify that the Modulation Analyzer reading is <102.2 kHz. Record the reading.

22. Program the Low Frequency Synthesized Signal Generator for level of 707.1 mV rms at the UUT MOD IN connector as read on the RMS Voltmeter.

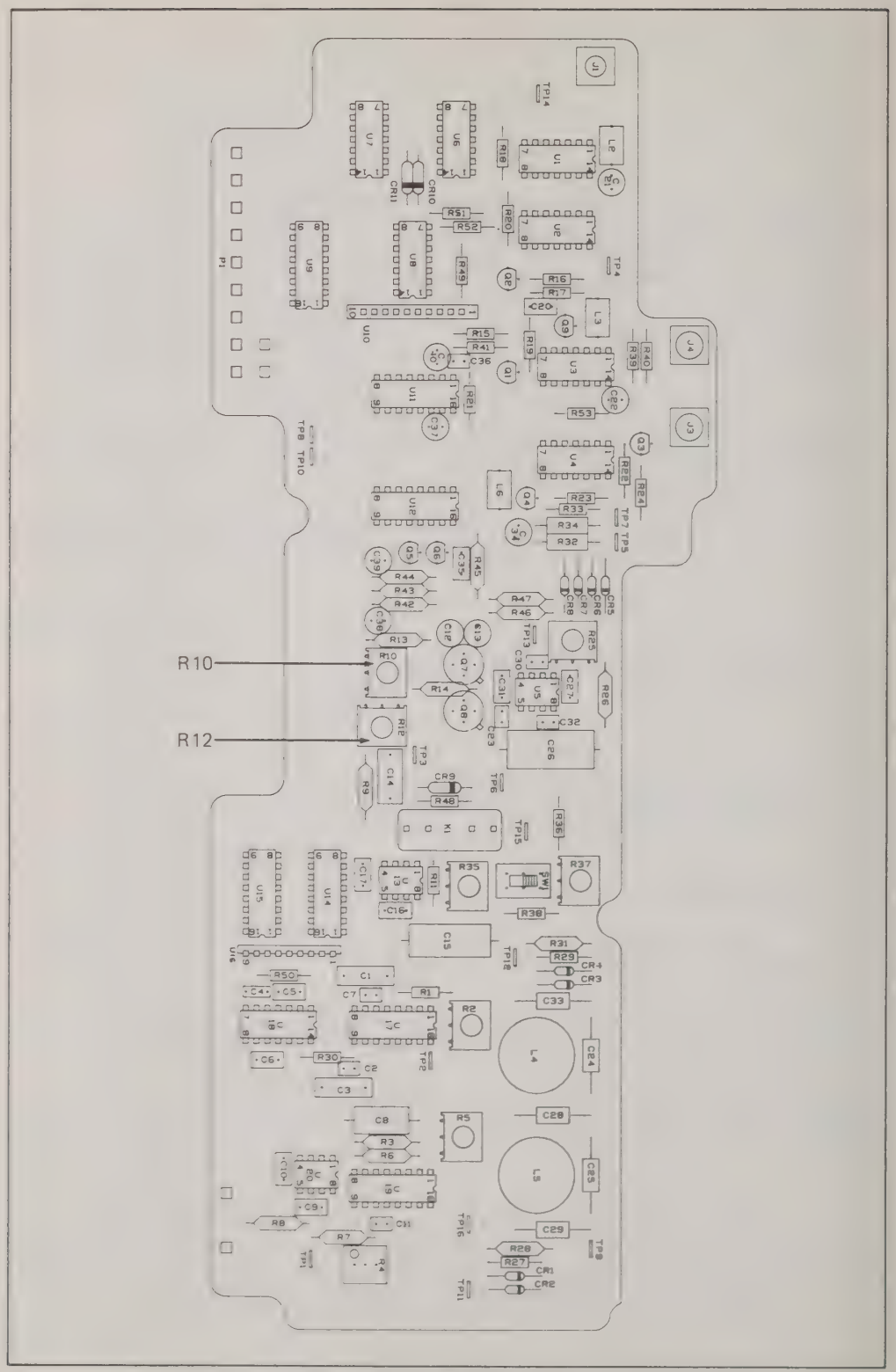


Figure 6-7. A3A1 Phase Detector PCB

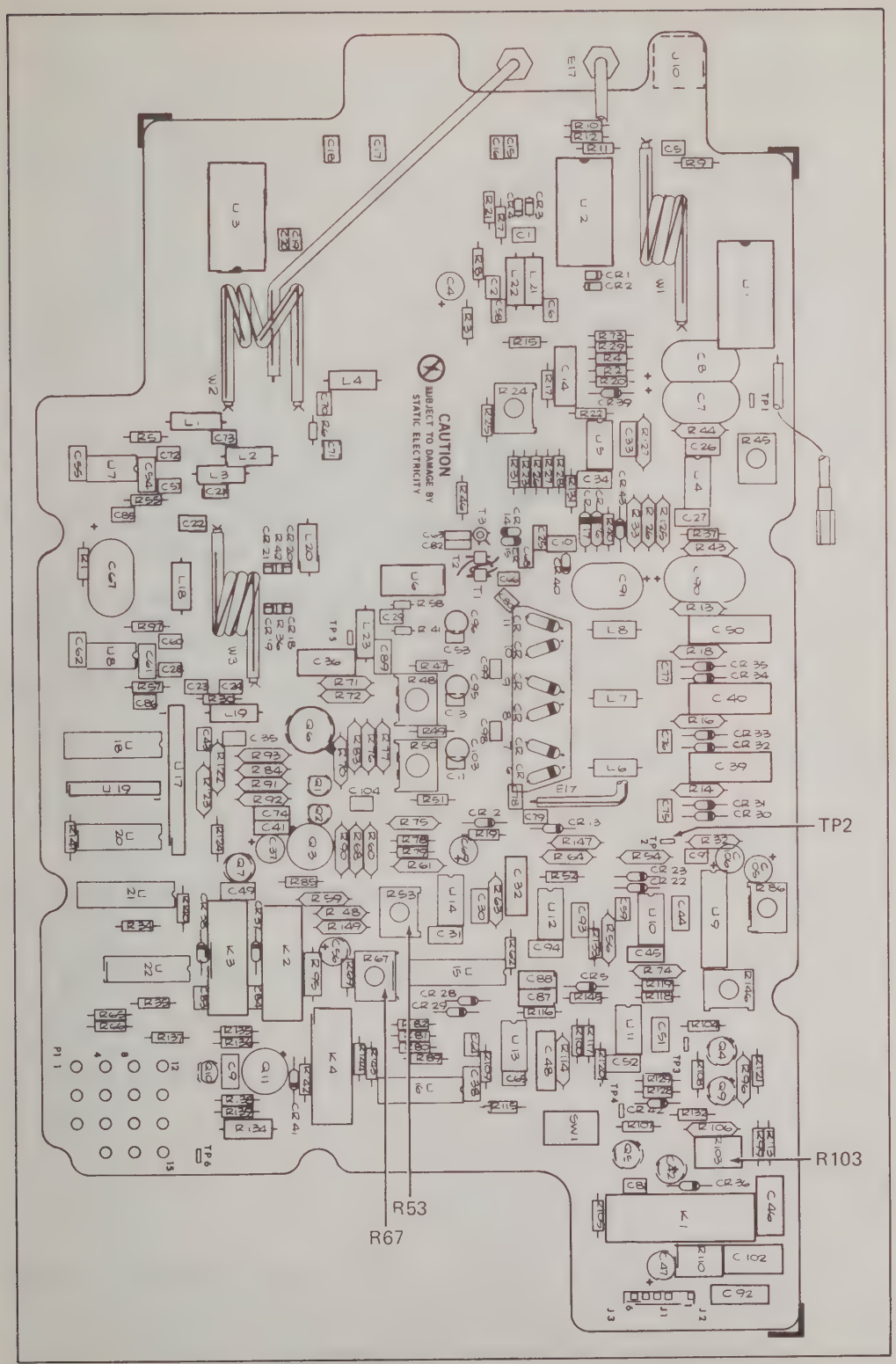


Figure 6-8. A3A3 Delay Discriminator PCB

23. Program the UUT for an FM deviation of 99.9 kHz.

24. Adjust R53 on the A3A3 Delay Discriminator PCB (Figure 6-8) until the Modulation Analyzer reading is the same as the reading recorded in Step 20.

25. Disconnect all test equipment. Assemble the UUT using the assembly portions of the Interior Access Procedure, the A3A1 Phase Detector PCB Access Procedure, and the A3A3 Delay Discriminator PCB Access Procedure.

26. After the UUT has thermally stabilized, repeat Procedure I.

6-17. AM and Level Adjustment Procedure

PURPOSE:	Provide final check and adjustment of the AM and level circuitry.
TEST EQUIPMENT:	Low Frequency Synthesized Signal Generator, Modulation Analyzer, Calibrated Power Meter
REMARKS:	1. The AM adjustments must always be performed before the level adjustments. 2. The UUT and all test equipment must be at room temperature and must be operating for at least 30 minutes before this procedure is started.

6-18. Complete the following steps to provide a final check and adjustment of the AM and level circuitry.

1. Perform the AM calibration on the Modulation Analyzer using the internal calibrator as follows:

   a. Connect the calibrator output of the Modulation Analyzer to the RF input of the Modulation Analyzer.

   b. Press AM, +PEAK, CALIBRATION and wait for one minute.

   c. Press 16.1, SPCL to enable application of the internal calibration factor.

   d. Remove the connection between the Modulation analyzer calibrator output and RF input.

2. Remove the bottom cover of the UUT (procedures in Section 3). Do not remove the module covers.

3. Set up the equipment as follows:

   a. Connect the output of the Low Frequency Synthesized Signal Generator to the MOD IN connector on the UUT and turn on the EXT AM control.

   b. Program the Low Frequency Synthesized Signal Generator for a 3 kHz signal at a level of 0.7071 V rms at the UUT MOD IN connector.

c. Connect the UUT RF OUTPUT connector to the Modulation analyzer RF input.

d. Program the Modulation Analyzer for AM, AUTO, −PEAK, 15 kHZ low pass filter on.

e. Program the UUT for an RF output frequency of 110 MHz, a level of +4 dBm, and an AM depth of 69.5%.

4. Allow the Modulation Analyzer to settle, and record the settled reading. Press −PEAK and record the new reading. Adjust R22 on the A4A10 Mod Distribution PCB (Figure 6-5) so that the readings are symmetrical about 70.0% AM. Press +PEAK and −PEAK as necessary for new readings.

5. Disconnect the Modulation Analyzer.

6. Set up the equipment as follows:

a. Program the UUT for an RF output frequency of 50 MHz at a level of +5 dBm. Turn off the UUT MODULATION and the RF OUTPUT ON controls off.

b. Connect the Power Meter head to the UUT RF OUTPUT connector.

c. Set the Power Meter range switch to −20 dBm and press FINE ZERO. Verify that the Power Meter zero reading has stabilized. Set the Power Meter RANGE switch to +10 dBm.

7. Turn on the UUT RF OUTPUT ON control.

8. Adjust R55 on the A4A10 Mod Distribution PCB (Figure 6-5) for a reading of approximately +5 dBm on the Power Meter.

9. Program the UUT for an RF output level of +9 dBm and adjust R55 for a reading of exactly +9 dBm on the Power Meter.

10. Disconnect all test equipment and replace all covers (procedures in Section 3).

6-19. Output Amplifier Adjustment Procedure

PURPOSE:	To provide final adjustment of the output amplifier.
TEST EQUIPMENT:	System DMM, True RMS Voltmeter, 50Ω TERMINATION JF442905
REMARKS:	Although the same procedure is used to adjust the output amplifier in the 6070A and the 6071A, the component numbers of some devices to be adjusted vary between the two models. When there is a difference in component numbers, the 6070A component number is enclosed in paretheses. Figure 6-9 shows the location of all adjustments.

6-20. Complete the following steps to adjust the output amplifier circuitry:

1. Use the procedures in Section 3 to access the output amplifier (A4A7 Output Amplifier PCB for 6070A or A4A6 X2 Output Amplifier PCB for 6071A).

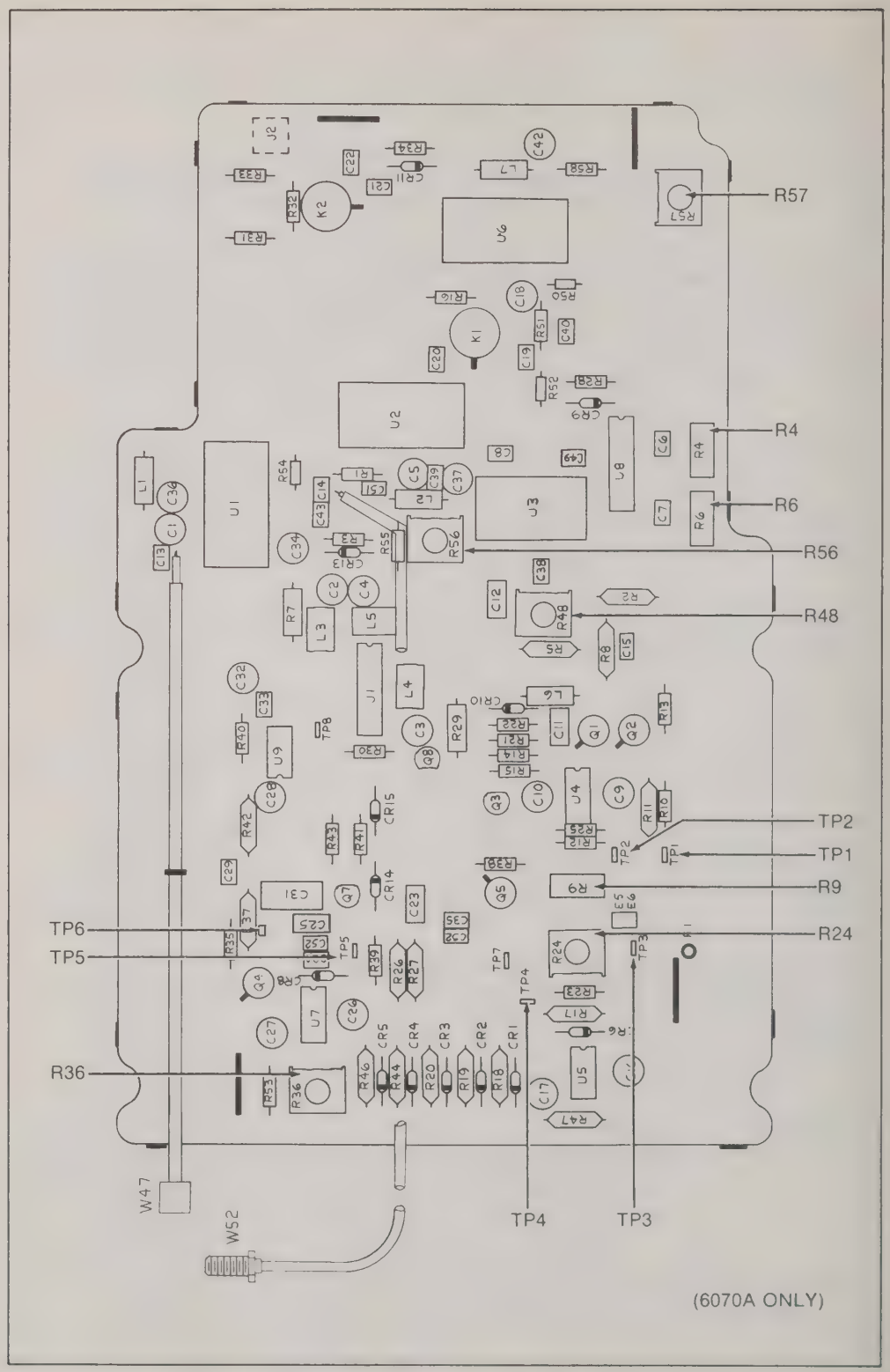


Figure 6-9. Output Amplifier PCB

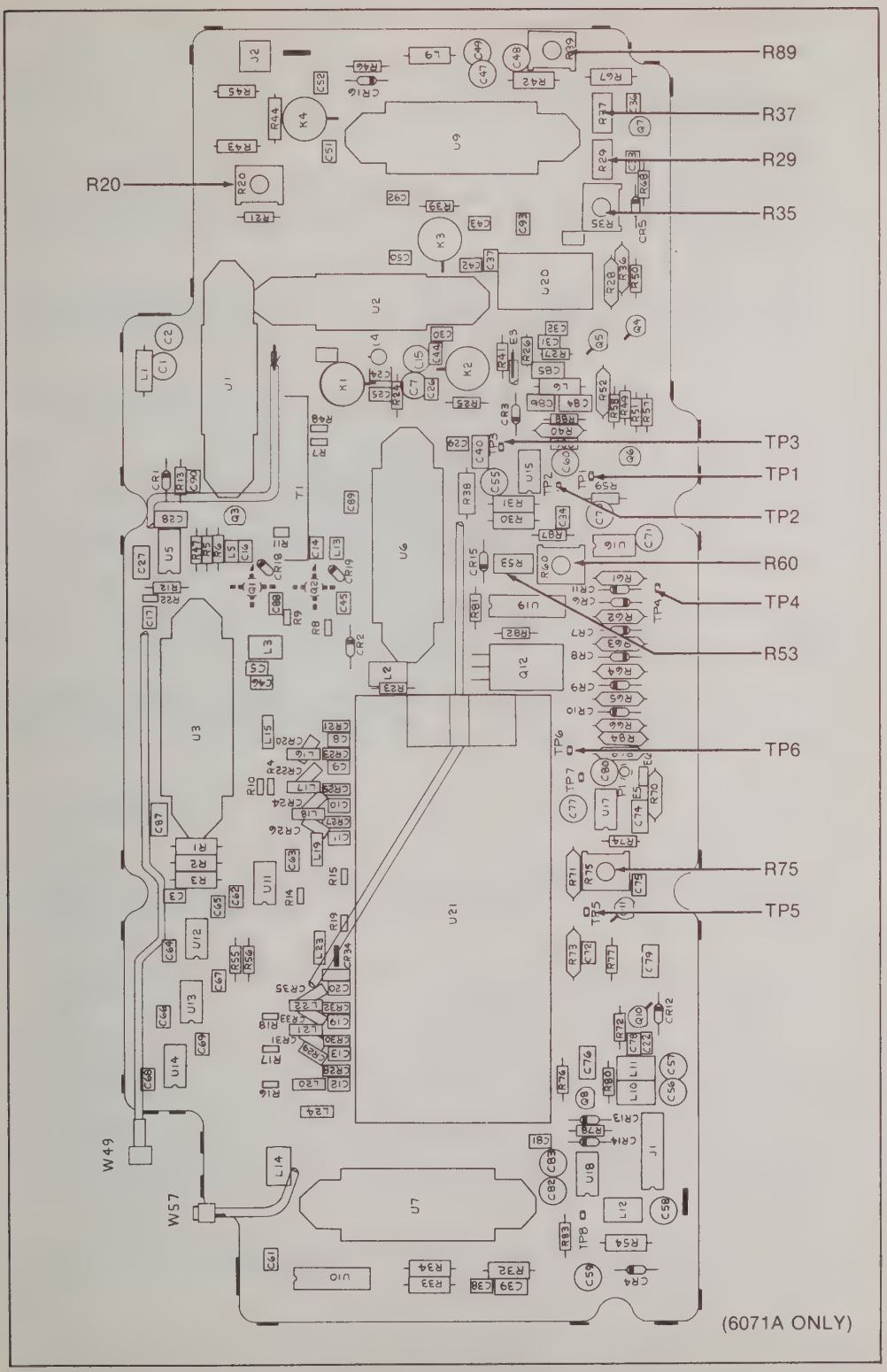


Figure 6-9. Output Amplifier PCB (cont)

2. Set up the equipment as follows:

   a. Program the UUT for an RF output frequency of 5 MHz at a level of +10 dBm. Turn off the RF OUTPUT ON control. Use the EDIT and DIGIT controls to place the Bright Digit at the 1 kHz position in the FREQUENCY Display.

   b. Connect the True RMS Voltmeter through a FJ442905 50 ohm termination to J1 of the Output Module. (If the 6070A-870 Reverse Power Protection Option is installed, connect the meter to J3 instead of J1). Set the True RMS Voltmeter to measure dB.

   c. Set the System DMM to dc volts, autoranging. Short the test leads together and zero the System DMM on its most sensitive range. Connect the HI test lead to TP1 and the LO test lead to TP2 on the output amplifier.

3. Adjust R53 (R9 if 6070A) for a reading of -20 ±20 μV on the systems DMM.

4. Connect the Systems DMM HI test lead to TP3 and the Lo test lead to TP4. Adjust R60 (R24 if 6070A) for a reading of 0 ±20 μV on the System DMM.

5. Turn on the RF OUTPUT ON control. Verify that the UNCAL annunicator is not flashing.

6. Connect the System DMM HI test lead to TP5 and LO test lead to TP6. Adjust R75 (R36 to 6070A) for a reading of 0 ±20 μV on the System DMM.

7. Turn off the UUT RF OUTPUT ON control. Connect the Systems DMM HI test lead to TP3 and LO test lead to TP2. Adjust R29 (R4 if 6070A) for a reading of 0 ±80 μV on the System DMM.

8. Use the Edit Knob to decrease RF output frequency to 4.999 MHz and record the Systems DMM reading.

9. Use the Edit Knob to increase RF output frequency to 5 MHz. Adjust R29 (R4 if 6070A) for a System DMM reading that is 1/3 the magnitude of the reading recorded in Step 8.

10. Use the Edit Knob to decrease RF output frequency to 4.999 MHz. Adjust R37 (R6 if 6070A) for a reading of 0 ±80 μV.

11. Use the Edit Knob to increase RF output frequency to 5 MHz. Adjust R29 (R4 if 6070A) for a System DMM reading of 0 ±40 μV on the Systems DMM.

12. Use the Edit Knob to decrease RF output frequency to 4.999 MHz. Verify that the Systems DMM reading is 0 ±40 μV. If the reading is not 0 ±40 μV, repeat Steps 10 through 12 until the reading is 0 ±40 μV with either RF output frequency programmed.

13. Use the Edit Knob to increase RF output frequency to 5 MHz. Turn on the RF OUTPUT ON control.

14. Set the True RMS Voltmeter to the relative mode.

15. Use the Edit Knob to decrease RF output frequency to 4.999 MHz. Note the

reading and adjust R35 (R48 if 6070A) for a True RMS Voltmeter reading of 1/2 the magnitude of the noted reading.

16. Repeat Steps 7 through 15 until the readings on the Systems DMM are 0 ±40 μV and the readings on the True RMS Voltmeter change less than 0.05 dB between the two frequencies.

17. Disconnect the test equipment. Use the access procedures in Section 3 to assemble the UUT.

6-21. TIMEBASE ADJUSTMENT PROCEDURE

PURPOSE:	To adjust the 10 MHz Timebase.
TEST EQUIPMENT:	Frequency Standard, Frequency Counter
REMARKS:	1. This procedure is for the UUT standard timebase. If the UUT has the 607XA-130 Oven Reference Option installed use the adjustment procedure in Section 7A. (The 10 MHz Timebase can be adjusted even if the 607XA-130 Option is installed by setting the INT XO/OPTION 130 Switch to the INT X0 position). 2. The UUT and all test equipment must be at room temperature and must be warmed up for at least 30 minutes before this procedure is started.

6-22. Use the following procedure to adjust the 10 MHz Timebase:

1. Use the Internal Access Procedure (Section 3) to remove the top cover of the instrument.

2. If the 607XA-130 Oven Reference Option is installed, set the INT XO/OPTION 130 switch to the INT XO position. If the option isn't installed, go to Step 3.

3. Connect the Frequency Standard to the REF IN connector on the Frequency Counter.

4. Connect the UUT REF OUT to the Channel A input of the Frequenc Counter.

5. On the UUT, adjust C9 on the 10 MHz Timebase PCB (C9 has an access hole in the module cover) so that the Frequency Counter displays 10 MHz ±2 Hz.

6. If the 607XA-130 Oven Reference Option is installed, return the INT XO/OPTION 130 switch to the OPTION 130 position.

7. Use the Interior Access Procedure (Section 3) to replace the UUT cover.

Section 7
Performance Checks and Calibration of Options

The following subsections describe the performance checks and calibration procedures for options to the 6070A and the 6071A. Each option has a separate subsection. For example, the performance check for the 607XA-130 Option is described in Section 7A.

Section 7A
607XA-130 Oven Reference Option Performance Check and Adjustment

7A-1. INTRODUCTION

7A-2. The information in this section describes the performance check and adjustment procedure for the 607XA-130 Oven Reference Option. Additional information about the Oven Reference Option is provided when appropriate throughout the 6070A/6071A Instruction Manual Set..

7A-3. PERFORMANCE CHECK

PURPOSE:	Verify that the frequency of the UUT timebase is within specified limits.
TEST EQUIPMENT:	Frequency Standard, and Frequency Counter
REMARKS:	1. This procedure is for a UUT with the 607XA-130 Oven Reference Option installed. for instruments with the standard timebase installed, see the Frequency Accuracy Check in Section 5. 2. The UUT must be warmed up, with the covers in place, for at least 30 minutes before attempting this procedure.

7A-4. Complete the following steps to verify that the frequency of the UUT timebase is within specified limits.

1. Connect the Frequency Standard output to the 10 MHZ REF IN connector on the counter.

2. Connect the UUT REF OUT connector to the counter CHANNEL A input connector.

3. Verify that the counter display is 10 MHz +/- 0.1 Hz.

7A-5. ADJUSTMENT PROCEDURE

PURPOSE:	Verify that the frequency of the UUT timebase is within specified limits.

TEST EQUIPMENT: Frequency Standard, and Frequency Counter

REMARKS:

1. This procedure is for a UUT with the 607XA-130 Oven Reference Option installed. For instruments with the standard timebase installed, see the Frequency Accuracy Check in Section 5.

2. The UUT must be warmed up, with the covers in place, for at least 30 minutes before attempting this procedure.

7A-6. Complete the following steps to adjust the frequency of the UUT timebase.

1. Connect the Frequency Standard output to the 10 MHZ REF IN connector on the counter.

2. Connect the UUT RF OUTPUT connector to the counter CHANNEL A input connector.

3. Program the UUT for an RF OUTPUT of 100 MHz at a level of 100 mV.

4. Use the Interior Access procedure in Section 3 to remove the top cover of the UUT. The Oven Reference Option is located in the right rear corner of the UUT.

5. Rotate the FINE and COARSE adjustments so that that counter reading is 100 MHz $\pm$1 Hz (for error less than 1 x 10^{-8}) or better if needed.

Section 7B
607XA-831 Auxiliary Output Option Performance Check

7B-1. INTRODUCTION

7B-2. The information in this section describes the performance check for the 607XA-831 Auxiliary Output Option. The 6070XA-831 Option has no calibration adjustments. Additional information about the Auxiliary output Option is provided when appropriate throughout the 6070A/6071AInstruction Manual Set.

7B-3. PERFORMANCE CHECK

PURPOSE:	To Verify the level of the signal at the AUX OUT connector.
TEST EQUIPMENT:	True RMS Voltmeter
REMARKS:	The auxiliary output signal is intended for use as a frequency reference, so that: 1. The frequency of the AUX OUT signal matches the accuracy and precision of the RF OUTPUT signal. 2. The level of the AUX OUT signal is independent of the programmed RF output. 3. The accuracy of the AUX OUT signal level is not guaranteed.

7B-4. Complete the following steps to verify the level of the signal at the AUX OUT connector.

1. Program the UUT for an RF output frequency of 10 MHz at a level of +13 dBm.

2. Verify the level of the AUX OUT signal:

   a. Connect the UUT AUX OUT to the True RMS Voltmeter input through a 50 Ohm termination.

   b. Set the True RMS Voltmeter controls to:

REL/dBm	dBm
dB/VOLTS	dB
dBm REFERENCE	50 Ohm

   c. Verify that the True RMS Voltmeter displays a level greater than –10 dBm.

Section 7C
607XA-870 Reverse Power Protection Option Adjustment

7C-1. INTRODUCTION

7C-2. The information in this section describes the adjustment procedure that sets the trip point for the 607XA-870 Reverse Power Protection (RPP) Option. Additional information about the RPP Option is provided when appropriate throughout the 6070A/6071A Instruction Manual Set.

7C-3. RPP TRIP POINT ADJUSTMENT PROCEDURE

PURPOSE:	To set the trip point of the RPP circuit just above the open-circuit trip point at any frequency and phase.
TEST EQUIPMENT:	Approximately six feet RG58 coaxial cable with BNC connectors, BNC to Type-N adapter.
REMARKS:	1. The RF OUTPUT ON control flashes to indicate that the RPP circuit has tripped. 2. Press and release the RF OUTPUT ON control to reset the RPP circuit.

7C-4. Complete the following steps to perform the RPP Trip Point Adjustment Procedure:

1. Use the appropriate procedures in Section 3 to access the A4A5 R.P.P. PCB.

2. Program the UUT RF output frequency to 200 kHz at a level of +20 dBm. If the RF OUTPUT ON control is flashing (RPP circuit tripped), go to Step 3. If the RF OUTPUT ON control is not flashing, adjust R7 cw on the A4A5 R.P.P. PCB so that the RF OUTPUT ON control is flashing.

3. Adjust R7 ccw until the RPP circuit can just be reset.

4. Use the DIGIT and EDIT controls to place the Bright Digit at the 100 kHz position of the FREQUENCY Display.

5. Edit frequency from 200 kHz to 10 MHz while watching for the RPP circuit to trip.

6. At each frequency where the RPP circuit trips, adjust R7 so that the RPP circuit

can just be reset. Verify that the adjustment is correct by editing back through that frequency to make sure that the RPP circuit no longer trips.

7. Use the DIGIT and EDIT controls to place that Bright Digit at the 1 MHz position of the FREQUENCY Display.

8. Edit frequency from 10 MHz to 519 MHz (1040 MHz with 6071A). Repeat the procedure described in Step 6 whenever the circuit trips.

9. Connect the 6 foot coaxial cable to the UUT RF OUTPUT connector through the BNC to Type-N adapter. Leave the other end of the coaxial cable unterminated. Repeat Steps 5 through 7 so that the RPP circuit doesn't trip at any frequency with the cable connected.

10. Note the final position of R7. Adjust R7 1/8 turn further ccw.

11. Repeat Steps 5 through 8. Verify that the RPP circuit does not trip.

12. Disconnect the coaxial cable and use the access procedures in Section 3 to assemble the instrument.

Appendix A
Fluke Sales and Service Centers

Appendix A contains four tables that list the address and telephone numbers of each John Fluke Sales Representative and each John Fluke Service Center. These four tables are as follows:

1. Table A-1. Fluke Technical Service Centers - U.S. and Canada
2. Table A-2. Fluke Technical Service Centers - International
3. Table A-3. Sales Representatives - U.S. and Canada
4. Table A-4. Sales Representatives - International

Table A-1. Fluke Technical Service Centers - U.S. and Canada

UNITED STATES

CA, Burbank
Fluke Technical Center
2020 N. Lincoln Street
Burbank, CA 91504
(213) 849-4641

CA, Santa Clara
Fluke Technical Center
2300 Walsh Avenue
Santa Clara, CA 95050
(408) 985-1200

CO, Denver
Fluke Technical Center
1980 S. Quebec Street, Unit 4
Denver, CO 80231
(303) 750-1228

FL, Orlando
Fluke Technical Center
940 N. Fern Creek Avenue
Orlando, FL 32803
(305) 896-2296

IL, Rolling Meadows
Fluke Technical Center
1400 Hicks Road
Rolling Meadows, IL 60008
(312) 398-5800

MA, Waltham
Fluke Technical Center
244 Second Avenue
Waltham, MA 02154
(617) 890-1604

MD, Rockville
Fluke Technical Center
5640 Fishers Lane
Rockville, MD 20852
(301) 770-1576

MN, Apple Valley
Fluke Technical Center
7373 West 147th Street, Suite 196
Apple Valley, MN 55124
(612) 432-9400

NC, Greensboro
Fluke Technical Center
1310 Beaman Place
Greensboro, NC 27408
(919) 273-1918

NJ, Paramus
Fluke Technical Center
West 75th Century Road
Paramus, NJ 07652
(210) 262-9550

TX, Dallas
Fluke Technical Center
14400 Midway Road
Dallas, TX 75240
(214) 233-9945

WA, Mountlake Terrace
John Fluke Mfg. Co., Inc.
21707 66th Avenue W., Suite 1
Mountlake Terrace, WA 98043
(206) 774-2206

CANADA

ALB, Calgary
Allan Crawford Assoc., Ltd.
1935 30th Avenue N.E. #14
Calgary, ALB T2E 6Z5
(403) 230-1341

ONT, Mississauga
Allan Crawford Assoc., Ltd.
6503 Northam Drive
Mississauga, ONT L4V 1J5
(416) 678-1500

QUE, St. Laurent
Allan Crawford Assoc., Ltd.
7018 Cote de Liesse
St. Laurent, QUE H4T 1E7
(514) 731-8564

Table A-2. Fluke Technical Service Centers - International

ARGENTINA
Fluke Latin American
Service Headquarters
Virrey del Pino 4071
Buenos Aries, Argentina
Tel 523185

AUSTRALIA
Elmeasco Instrument Pty Ltd
P O. Box 30
Concord, N S W
Australia 2137
Tel. (02) 736-2888

AUSTRIA
Walter Rekirsch
Elektronische Gerate GmbH & Co
Vertriebs-KG
Liechtensteinstrasse 97/6
A-1090 Vienna, Austria
Tel 09-43-222-347646

BELGIUM
Fluke (Belgium)S.A./N.V
6, Rue de Geneve
1140 Brussels, Belgium
Tel 09-32-2-2164090

BRAZIL
Arotec S A
Industria e Comercio
Av. Pacaembu 811
01234 Sao Paulo S P , Brazil
Tel 826-2266

CHILE
Intronica Chile Ltda
Casilla 16228
Santiago 9, Chile
Tel. 44940

COLOMBIA
Coasin Ltda
Carrera 13, # 37-37, Of. 407
Ap. Aero 29583
Bogota DE, Colombia
Tel. 285-0230

DENMARK
Tage Olsen A/S
Ballerup Byvej 222
DK-2750 Ballerup
Denmark
Tel: (01) 2-65 81 11

ECUADOR
Proteco Coasin Cia., Ltda
Edificia "Jerico"
Ave. 12 de Octubre #2285y
Ave. Orellana (Planta Baja)
Quito, Ecuador
Tel 526759

EGYPT
Lotus Engineering Organisation
P O Box 1252
Cairo, Egypt
Tel 71617

FINLAND
Oy Findip AB
Teollisuustie 7
02700 Kauniainen
Finland
Tel: 09-358-0-502255

FRANCE
M.B. Electronique S.A.
Rue Fourny
ZAC de BUC
B.P #31
78530 BUC, France
Tel: 09-33-1-9568131

GREECE
Hellenic Scientific
Representations Ltd
11, Vrassida Street
Athens 615, Greece
Tel 09-30-1-711140

HONG KONG
Gilman Industrial Bldg., 9F
107-109 Wai Yip Street
Kwun Tong
Kowloon, Hong Kong
Tel 3-427144

Table A-2. Fluke Technical Service Centers - International (cont)

INDIA
Hinditron Services Pvt. Ltd.
"Hinditron House"
412 Raj Mahal Vilas Extension
Bangalore 560 006, India
Tel: 33139

Hinditron Services Pvt. Ltd.
69 A.L. Jagmohandas Marg
Bombay 400 006, India
Tel: 365344

INDONESIA
P.T. Dwi Tunggal Jaya Sakti
Sangga Buana Bldg., 1st Floor
J1. Senen Raya 44, P.O. Box 4435
Jakarta, Indonesia
Tel: 376608

IRAN
Irantronics Company Ltd.
20 Salm Road
Roosevelt Avenue
Tehran, Iran
Tel: 828294/831564

ISRAEL
R.D.T. Electronics Engineering Ltd.
P.O. Box 75
46, Sokolov Street
Ramat Hasharon 47235
Israel
Tel: 09-972-3-483211

ITALY
Sistrel S.p.A.
Via Timavo 66
20099 Sesto S. Giovanni (Milan)
Italy
Tel: 09-39-2-2476693

Sistrel S.P.A.
Via Guiseppe Armellini #37
00143 Rome, Italy
Tel: 09-39-6-5915551

JAPAN
John Fluke Mfg. Co., Inc.
Japan Branch
1 Higashikata-machi
Midori-ku
Yokohama 226, Japan
Tel: (045) 473-5425

KOREA
Electro-Science Korea Co.
C.P.O. Box 8446
Room 1201 Bowon Bldg.
490 Chongro - 5 Ka
Chongro-ku
Seoul, Korea
Tel: 261-7702

MALASIA
O'Connor's (Malaysia) SDN. BHD.
P.O. Box 91
Petaling Jaya, Selangor
West Malaysia
Tel: 51563

MEXICO
C.J. Christensen S.A. De C.V
Melchor Ocampo 150-8
Mexico 4 D.F., Mexico
Tel: (905) 535-2258

NETHERLANDS
Fluke (Nederland) B.V
P.O. Box 5053
5004 EB Tilburg
The Netherlands
Tel: (013) 673973

NEW ZEALAND
W & K McLean Ltd
P.O. Box 18065
Glen Innes
Auchland, New Zealand
Tel. 587-037

NORWAY
Morgenstierne & Co. A/A
Konghellegate 3
P.O. Box 6688, Rodelokka
Oslo 5, Norway
Tel: 09-47-2-356110

PAKISTAN
Pak International Operations
505 Mohammadi House
1.1. Chundrigar Road
Katrachi-2 Pakistan
Tel: 221127/239052

PERU
Importaciones Y Representaciones
Electronicas S.A
Avda. Franklin D. Roosevelt 105
Lima 1, Peru
Tel: 288650

PORTUGAL
Equipamentos de Laboratorio, Ltda
P.O. Box 1100
Lisbon 1002, Portugal
Tel: 09-351-1-578936/547512

REPUBLIC OF SINGAPORE
Rank O'Connor's (PTE) Ltd
98 Pasir Panjang Road
Singapore 0511
Republic of Singapore
Tel: 637944

REPUBLIC OF SOUTH AFRICA
Fluke S.A. (Pty) Ltd.
P.O. Box 39797
Bramley 2018
Republic of South Africa
Tel: (011) 786-3170

SPAIN
Hispano Electronica S.A.
Apartado de Correos 48
Alcorcon (Madrid)
Spain
Tel: 09-3416194108

SWEDEN
Teleinstrument AB
P.O. Box 490
S-162 Vallingby 4
Sweden
Tel: 09-46-8-380370

SWITZERLAND
Traco Electronic AG
Jenatschstrasse 1
8002 Zurich
Switzerland
Tel. 09-41-1-2010711

TAIWAN
CCT Associates, Inc.
P.O. Box 24209
Taipei, Taiwan
Republic of China
Tel: (02) 391-6894/393-5760

THAILAND
Dynamic Supply Engineering R.O.P
56 Ekamai, Sukhumvit 63
Bangkok-11, Thailand
Tel. 914434/928532

TURKEY
Erkman Electronik Aletler
Ticaret Anonim Sirketi
Necatiby Cad 92/3
Karakoy, Istanbul, Turkey
Tel: 09-44-1-5461

UNITED KINGDOM
Fluke International Corp. - UK
Colonial Way
Watford, Herts. WD24TT
United Kingdom
Tel: 09-4492340511

URUGUAY
Coasin Uruguaya S.R.L.
Edifico Ciudadela
Sarandi 690 D. Esc. 109
Casilla de Correos 1400
Correo Central
Montevideo, Uruguay
Tel: 917978

VENEZUELA
Coasin C.A.
Apdo. Postal 50939
Sabana Grande # 1
Caracas 105, Venezuela
Tel: 782-9109

WEST GERMANY
Fluke (Deutschland) GmbH
Krausstrasse 32
8045 Ismaning
West Germany
Tel: (089) 96251

Customers in the following countries: Bulgaria, Czechoslovakia, Hungary, Poland, Romania, U.S.S.R., and Yugoslavia, contact: Amtest Associates Ltd., P.O. Box 55, Addlestone, Surrey, KT 15 1DU, England, Tel. (0932) 52121

Table A-3. Sales Representatives - U.S. and Canada

UNITED STATES

AK, Anchorage
Harry Lang & Associates
1371 Hillcrest Drive #303
Anchorage, AK 99503
(907) 279-5741

AL, Huntsville
John Fluke Mfg. Co., Inc.
3322 Memorial Parkway
Huntsville, AL 35807
(205) 881-6220
(404) 321-0980 (Atlanta)

AZ, Tempe
John Fluke Mfg. Co., Inc.
2125 S. 48th Street, Suite 104
Tempe, AZ 85285
(602) 967-8724

CA, Los Angeles
John Fluke Mfg. Co., Inc.
20902 S. Bonita Street
Carson, CA 90746
(213) 538-3900

CA, Santa Clara
John Fluke Mfg. Co., Inc.
2300 Walsh Avenue
Santa Clara, CA 95050
(408) 244-1505

CA, Tustin
John Fluke Mfg. Co., Inc.
15445 Red Hill Avenue, Suite F
Tustin, CA 92680
(714) 838-8863
(714) 226-1254 (San Diego)

CO, Denver
John Fluke Mfg. Co., Inc.
1980 S. Quebec, #4
Denver, CO 80231
(303) 750-1222

CT, Hartford
John Fluke Mfg. Co., Inc.
124 Hebron Avenue
Glastonbury, CT 06033
(203) 633-0777

FL, Orlando
John Fluke Mfg. Co., Inc.
940 N. Fern Creek Avenue
Orlando, FL 32803
(305) 896-4881

HI, Honolulu
EMC Corporation
2979 Ualena Street
Honolulu, HI 96819
(808) 847-1138

IA, Iowa City
John Fluke Mfg. Co., Inc.
1027 Hollywood Blvd., Suite 309
Iowa City, IA 52240
(319) 354-2811

IL, Chicago
John Fluke Mfg. Co., Inc.
4300 Lincoln, Unit K
Rolling Meadows, IL 60008
(312) 398-0850

IN, Indianapolis
John Fluke Mfg. Co., Inc.
5610 Crawfordsville Road,
Suite 802
Indianapolis, IN 46224
(317) 244-2456

LA, Metairie
John Fluke Mfg. Co., Inc.
2700 Kingman Street, Suite 103
Metairie, LA 70002
(504) 455-0814

MA, Waltham
John Fluke Mfg. Co., Inc.
244 Second Avenue
Waltham, MA 02154
(617) 890-1600

MD, Baltimore
John Fluke Mfg. Co., Inc.
5640 Fishers Lane
Rockville, MD 20852
(301) 770-1570
(301) 792-7060 (Baltimore)

MI, Detroit
John Fluke Mfg. Co., Inc.
13955 Farmington Road
Livonia, MI 48154
(313) 522-9140

MN, Minneapolis
John Fluke Mfg. Co., Inc.
7373 W. 147th Street, Suite 196
Apple Valley, MN 55124
(612) 432-9400

MO, Kansas City
John Fluke Mfg. Co., Inc.
4406 Chouteau Traffic Way
Kansas City, MO 64117
(816) 454-5836

MO, St. Louis
John Fluke Mfg. Co., Inc.
300 Brookes Drive, Suite 100
Hazelwood, MO 63042
(314) 731-3388

NC, Greensboro
John Fluke Mfg. Co., Inc.
1310 Beaman Place
Greensboro, NC 27408
(919) 273-1918

NJ, Paramus
John Fluke Mfg. Co., Inc.
West 75 Century Road
Paramus, NJ 07625
(201) 262-9550

NM, Albuquerque
John Fluke Mfg. Co., Inc.
1108 Alvarado Drive N.E.
Albuquerque, NM 87110
(505) 265-8431

NY, Rochester
John Fluke Mfg. Co., Inc.
4515 Culver Road
Rochester, NY 14622
(716) 266-1400

OH, Cleveland
John Fluke Mfg. Co., Inc.
7830 Freeway Circle
Middleburg Heights, OH 44130
(216) 234-4540

OH, Dayton
John Fluke Mfg. Co., Inc.
4756 Fishburg Road
Dayton, OH 45424
(513) 233-2238

OR, Portland
John Fluke Mfg. Co., Inc.
18360 S.W. Springfield Lane
Aloha, OR 97006
(502) 642-1342

PA, Philadelphia
John Fluke Mfg. Co., Inc.
1010 W. 8th Avenue, Suite H
King of Prussia, PA 19406
(215) 265-4040
(412) 261-5171 (Pittsburgh)

TX, Austin
John Fluke Mfg. Co., Inc.
111 W. Anderson Lane, Suite 213
Austin, TX 78752
(512) 478-9901

TX, Dallas
John Fluke Mfg. Co., Inc.
14400 Midway Road
Dallas, TX 75243
(214) 233-9990

TX, Houston
John Fluke Mfg. Co., Inc
1014 Wirt Road, Suite 270
Houston, TX 77055
(713) 683-7913
(512) 222-2726 (San Antonio)

UT, Salt Lake City
John Fluke Mfg. Co., Inc
782 E. 8325 South
Sandy, UT 84070
(801) 566-4864

WA, Kennewick
John Fluke Mfg. Co., Inc.
3613 W. 16th Place #C
Kennewick, WA 99336

WA, Seattle
John Fluke Mfg. Co., Inc
975 Industry Drive
Seattle, WA 98188
(206) 575-3765

For more information on Fluke products or Sales Offices you may dial (800) 426-0361 toll free in most of U.S. From Alaska, Hawaii, Washington, or Canada phone (206) 774-2481. From other countries phone (206) 774-2398.

Table A-3. Sales Representatives - U.S. and Canada (cont)

CANADA

ALB, Calgary
Allan Crawford Assoc., Ltd.
1935 30th Avenue N.E., #14
Calgary, ALB T2E 6Z5
Tel: (403) 230-1341

BC, North Vancouver
Allan Crawford Assoc., Ltd
3795 William Street
Burnaby, BC Y5C 3H3
Tel: (604) 294-1326

NS, Halifax
Allan Crawford Assoc., Ltd
Townsend Place, Suite 201
800 Windmill Road
Burnside Industrial Park
Dartmounth, NS B3B 1L1
Tel: (902) 469-7865

ONT, Ottawa
Allan Crawford Assoc., Ltd
1299 Richmond Road
Ottawa, ONT K2B 7Y4
Tel: (613) 829-9651

ONT, Toronto
Allan Crawford Assoc., Ltd.
6503 Northam Drive
Mississauga, ONT L4V 1J5
Tel: (416) 678-1500

QUE, Montreal
Allan Crawford Assoc., Ltd.
7018 Cote de Liesse
St. Laurent, QUE H4T 1E7
Tel: (514) 731-8564

For Canadian areas not listed, contact the office nearest you or Allan Crawford Assoc. Ltd., Mississauga (Toronto), Ontario.

Table A-4. Sales Representatives - International

Supplied and Supported by Fluke International Corporation, P.O. Box 43210, Mountlake Terrace, WA 98043, Tel: (206) 774-2398, TLX: 152662 JOHNFLUKE MTLT

ARGENTINA
Coasin S.A.
Virrey del Pino 4071
Buenos Aires, Argentina
Tel: 525130
TLX: 390122284 COASN AR

AUSTRALIA
Elmeasco Instruments Pty Ltd.
P.O. Box 30
Concord, N.S.W.
Australia 2137
Tel: (2) 736-2888
TLX: 79025887

Elmeasco Instruments Pty Ltd.
P.O. Box 107
Mt. Waverly, VIC. 3149
Australia
Tel: 233-4044
TLX: 26206 (ELMVIC)

Elmeasco Instruments Pty Ltd.
Professional Suite's Bldg.
B.P.O. Box 2360
Brisbane, 4001
Australia
Tel: (07) 229-3161

Elmeasco Instruments Pty Ltd.
P.O. Box 1240
G.P.O. Adelaide 5001
South Australia

BOLIVIA
Coasin Bolivia S.R.L.
Casilla 7295
La Paz, Bolivia
Tel: 40962
TLX: Public Booth # 5377, indicate "Para Coasin B.S.R.L., Av 6 de Agosto 2300 3er Piso, La Paz tl 40962"

BRAZIL
Arotec S.A.
Industria e Comercio
Av. Pacaembu 811
01234 Sao Paulo S.P., Brazil
Tel: (011) 67-2393
TLX: 1122207 AROT BR

Arotec S.A.
Rua Araguari, 1705 s 402
30.000 Belo Horizonte M.G., Brazil

Arotec S.A.
Av. Rio Branco 277
Grupo 1309
02000 Rio de Janeiro, R.J., Brazil
Tel: (021) 242-9776

BRUNEI
O'Connor's Limited
(Brunei Branch) Chin Kian Bldg
P.O. Box 2126
Bandar Seri Begawan, Brunei
Tel: 26680

CHILE
Intronica Chile Ltda.
Manuel Montt 024 - Of. D
Casilla 16228
Santiago 9, Chile
Tel: 44940
TLX. 40301 Cab Publ.,
Attn: Intronica Chile

CHINA, PEOPLE'S REPUBLIC OF
China National Instrument Import & Export Corp.
P.O. Box 49, Erh-Li-Kou
Hsi Chi'ao
Beijing
People's Republic of China
TLX: CO 2242 CNIEC

COLOMBIA
Coasin Ltda
Carrera 13, # 37-37, Of. 407
Ap. Aero 29583
Bogota DE, Colombia
Tel. 285-0230/0250
TLX: 45787 COASN CO

ECUADOR
Proteco Coasin Cia., Ltda
Edificio "Jerico"
Ave. 12 de Octubre #2285 y
Ave. Orellana (Planta Baja)
Quito, Ecuador
Tel: 529684
TLX: 2865 Protec Ed

Proteco Coasin Cia., Ltda
Casilla 9733
9 de Octubre 424
Edificio Gran Pasaje, Of. 1012
Guayaquil, Ecuador

HONG KONG
Gilman & Co., Ltd.
P.O. Box 56
Gilman Ind. Bldg. 9 F
107-109 Wai Yip Street
Kwun Tong, Kowloon
Hong Kong
Tel: 5-7909633
TLX: 73358 GILMN HX

ICELAND
Kristjan O. Skagfjord Ltd.
P.O. Box 906
Reykjavik, Iceland
Tel. 24120
TLX: 2133 KOS-1S

INDIA
Hinditron Services Pvt. Ltd.
69 A.L., Jagmohandas Marg
Bombay 400 006
India
Tel: 811316
TLX: 953-112326 Hspl In

Table A-4. Sales Representatives - International (cont)

Hinditron Services Pvt. Ltd.
"Hinditron House"
412 Raj Mahl Vilas Extension
Bangalore 560 006
India
Tel: 33139
TLX: 043741

INDONESIA
P.T. Dwi Tunggal Jaya Sakti
Sangga Buana Bldg., 1st Floor
Jl. Senen Raya 44, P.O. Box 4435
Jakarta, Indonesia
Tel: 367390-9
TLX: 46624 SABUANA 1A

P.T. Dwi Tunggal Jaya Sakti
Jalan Sasakgantung 45
Bandung, Indonesia
Tel: 367390-9
TLX: 46624 SABUANA 1A

JAPAN
John Fluke Mfg. Co., Inc.
Japan Branch
(PC Board Testers only)
1 Higashikata-machi
Midori-ku
Yokohama 226, Japan
Tel: (045) 473-5425
TLX: 3823-666 FLUKJPJ

Tokyo Electron Ltd.
38 Fl. Shinjuko Nomura Bldg.
1-26-2, Nishi-Shinjuku
Shinjuku-ku
Tokoyo 160, Japan
Tel: 03-343-4411
TLX: 2322220 LABTEL J

KENYA
Advanced Communications Ltd.
P.O. Box 30070
Nairobi, Kenya
East Africa
Tel: 331955
TLX: 22639 ADCOM

KOREA
Electro-Science Korea Co.
C.P.O. Box 8446
Room. 1201 Bowon Bldg.
490 Chongro - 5 Ka
Chongro-ku
Seoul, Korea
Tel: 261-7702
TLX: 78723270+

MALAYSIA
O'Connor's (PTE) Limited
P.O. Box 91
Petaling Jaya, Selangor
West Malaysia
Tel: 51563
TLX: OCONOR MA37649

O'Connor's (PTE) Limited
Lot # 5 Taman Mesra
Mile 3, Jalan Penampang
Kota Kinabulu
East Malaysia
Tel: 55322
TLX: MA80286FL

MEXICO
C.J. Christensen S.A. De C.V.
Instrumentos Electronicos
de Medicion
Melchor Ocampo 150-8
Mexico 4 D.F., Mexico
Tel: (905) 535-2258

NEW ZEALAND
W & K McLean Ltd.
P.O. Box 18065
Glen Innes
Auckland, New Zealand
Tel: 587-037
TLX: N.Z. 7912763

W & K McLean Ltd.
P.O. Box 2421
Christchurch, New Zealand

W & K McLean Ltd
P.O. Box 496
Wellington, New Zealand
Tel: 851-450

NIGERIA
Mofat Engineering Co., Ltd.
P.O. Box 6369
Lagos, Nigeria
TLX: 21353, Attn: MOFAT

PAKISTAN
Pak International Operations
505 Muhammadi House
- McLeod Road
P.O Box 5323
Karachi, Pakistan
Tel: 221127
TLX: 24494 PIO PK

PERU
Importaciones Y Representaciones
Electronicas S.A.
Avda. Franklin D. Roosevelt 105
Lima 1, Peru
Tel: 288650
TLX: 37425663

SINGAPORE
Rank O'Connor's (PTE) Limited
98 Pasir Panjang Road
Singapore 0511
Republic of Singapore
Tel: 637944
TLX: OCONSIN RS21023

SOUTH AFRICA
Fluke S.A. (Pty) Ltd.
P.O. Box 39797
Bramley 2018
Republic of South Africa
Tel: (011) 786-3170
TLX: 82899

TAIWAN
CCT Associates, Inc.
P.O. Box 24209
Taipei, Taiwan
Republic of China
Tel: (02) 391-6894
TLX: 24263 Longgulf

THAILAND
Dynamic Supply Engineering R.O.P.
56 Ekamai, Sukhumvit 63
Bangkok-11, Thailand
Tel: 914434
TLX: TH 82938 MONTIEN TH

URUGUAY
Coasin Uruguaya S.R.L
Edif. Ciudadela
Sarandi 690 D. Esc. 109
Casilla de Correos 1400
Correo Central
Montevideo, Uruguay
Tel: 917978
TLX: Public Booth UY901 Coasin

VENEZUELA
Coasin C.A.
Apdo. Postal 50939
Sabana Grande # 1
Caracas 105, Venezuela
Tel: 782-9109-8741
TLX: 39531228

Latin America also Supported by -

Sr. Leonardo Cusnir, c/o COASIN A.A., Virrey del Pino 4071, Buenos Aires, Argentina, Tel: 523185, TLX: 390122284 COASN AR

Sr. Benewaldo Padovani, c/o AROTEC S.A., Industria e Comericio, Av. Pacaembu 811, 01234 Sao Paulo S.P., Brazil, Tel: (011) 67-2393, TLX: 1122207 AROT BR

Table A-4. Sales Representatives - International (cont)

Supplied and Supported by Fluke (Holland) B.V., P.O. Box 5053, Zevenheuvelenweg 53, 5004 EB Tilburg, Netherlands, Tel: (013) 673973, TLX: 522337

AUSTRIA
Walter Rekirsch
Electronische Gerate GmbH & Co.
Vertriebs-KG
Liechtensteinstrasse 97/6
A-1090 Vienna, Austria
Tel: (222) 347646
TLX: 134759

BELGIUM
Fluke (Belguim) S.A./N.V.
6 Rue de Geneve
1140 Brussels, Belgium
Tel: (2) 2164090
TLX: 26312

BULGARIA
Amtest Associates Ltd.
P.O. Box 55
Addlestone, Surrey KT15 1DU
United Kingdom
Tel: Weybridge (923) 52121
TLX: 928855

CHAD
Fluke (Holland) B.V.
P.O. Box 5053,
Zevenheuvelenweg 53
5004 EB Tilburg, Netherlands
Tel: (013) 673973
TLX: 52237

CYPRUS
Chris Radiovision Ltd.
P.O. Box 1989
Nicosia, Cyprus
Tel: 66121
TLX: 2395

CZECHOSLOVAKIA
Amtest Associates Ltd.
P.O. Box 55
Addlestone, Surrey KT15 1DU
United Kingdom
Tel: Weybridge (932) 52121
TLX: 928855

DENMARK
Tage Olsen A/S
Ballerup Byvej 222
DK - 2750 Ballerup, Denmark
Tel: (2) 658111
TLX: 35293

EGYPT AND SUDAN
Lotus Engineering Organisation
P.O. Box 1252
22, Kasi El Nil
Cairo, Egypt
Tel: 971617
TLX: 92504

EIRE (REPUBLIC OF IRELAND)
Euro Electronics
32 Brews Hill
Naven, County Meath
Tel: 46-23577
TLX: 31821

ETHIOPIA
Fluke (Holland) B.V.
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5004 EB Tilburg, Netherlands
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TLX: 52237

FINLAND
Oy Findip AB
Teollisuustie 7
02700 Kauniainen, Finland
Tel: (0) 502255
TLX: 123129

FRANCE
M.B. Elctronique S.A.
Rue Fourny
ZAC de BUC
B.P. # 31
78530 BUC, France
Tel: (1) 9568131
TLX: 695414

GERMAN DEMOCRATIC REPUBLIC
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GERMAN FEDERAL REPUBLIC
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West Germany
Tel: (089) 96251
TLX: 0522472
Rapitax: (089) 966718

Fluke (Deutschland) GmbH
Meineckestrasse 53
4000 Dusseldorf 30
West Germany
Tel: (0211)450831
TLX: 8585576

Fluke (Deutschland) GmbH
Oberer Kirchhaldenweg 135
7000 Stuttgart 1
West Germany
Tel: (0711) 694091
TLX: 722518

PK Electronik
Lietzenburger Strasse 91
1000 Berlin 15
West Germany
Tel: (030) 8831058

GREECE
Hellenic Scientific
Representations Ltd.
11, Vrasside Street
Athens 615, Greece
Tel: (1) 711140
TLX: 219330

HUNGARY
Amtest Associates Ltd.
P.O. Box 55
Addlestone, Surrey KT15 1DU
United Kingdom
Tel: Weybridge (932) 52121
TLX: 928855

IRAN
Irantronics Company Ltd.
20. Salm Road
Roosevelt Avenue
Tehran, Iran
Tel: 828294/831564
TLX: 212956/212876

IRAQ
Fluke (Holland) B.V.
P.O. Box 5053,
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IRELAND
Euro Electronics
32 Brews Hill
Naven County Meath
Ireland
Tel: (46) 23577
TLX: 3182

ISRAEL
R.D.T. Electronics Engineering Ltd.
P.O. Box 75
46, Sokolov Street
Ramat Hasharon 47235
Israel
Tel: (3) 483211
TLX: 32143

ITALY
Sistrel S.p.A.
Via Giuseppe Armellini # 37
00143 Rome, Italy
Tel: (6) 5915551
TLX: 680356

Sistrel S.p.A.
Via Timavo 66
20099 Sesto S. Giovanni (Milan)
Italy
Tel: (2) 2476693
TLX: 320346

Sistrel S.p.A
Via Cintia
Parco S. Paolo 35
80126 Naples, Italy
Tel: (81) 7679700

KUWAIT
Tareq Company
P.O. Box Safat 20506
Kuwait, Arabian Gulf
Tel: 436100/436045
TLX: 2315

Table A-4. Sales Representatives - International (cont)

LEBANON AND JORDAN
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Tel: 252631/348728
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LIBYA
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P.O. Box 5053,
Zevenheuvelenweg 53
5004 EB Tilburg, Netherlands
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TLX: 52237

MOROCCO
Mainvest
Residence Moulay Ismail
Bat. C.
Boulevard Moulay Slimane
Rabat, Morocco
Tel: (7) 27664
TLX: 31036

NETHERLANDS
Fluke (Nederland) B.V.
P.O. Box 5053,
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5004 EB Tilburg, Netherlands
Tel: (013) 673973
TLX: 52237

NORWAY
Morgenstierne & Co. A/A
Konghellegate 3
P.O. Box 6688, Rodelokka
Oslo 5, Norway
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TLX: 11719

PDR YEMEN
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PORTUGAL
Equipamentos de Laboratorio, Ltda.
P.O. Box 1100
1002 Lisbon, Portugal
Tel: (1) 578936/547512
TLX: 18469

QATER, OMAN &
UNITED ARAB EMIRATES
Technology Organisation
P.O. Box 5549
Doha, Qatar
Tel: 321431
TLX: 4581

ROMANIA
Amtest Associates Ltd.
P.O. Box 55
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United Kingdom
Tel: Weybridge (932) 52121
TLX: 928855

SAUDI ARABIA
Electronic Equipment
Marketing Co. Ltd.
P.O. Box 3750
Riyadh, Saudi Arabia
Tel: 32761/32700/37023
TLX: 201120

SOMALIA
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Zevenheuvelenweg 53
5004 EB Tilburg, Netherlands
Tel: (013) 673973
TLX: 52237

SPAIN
Hispano Electronica S.A.
Piligono Industrial Urtinsa
Apartado de Correos 48
Alcorcon (Madrid)
Spain
Tel: (1) 6194108
TLX: 22404/42634

SWEDEN
Teleinstrument AB
P.O. Box 490
S-162 04 Vallingby 4
Sweden
Tel: (8) 380370
TLX: 11347

SWITZERLAND
Traco Electronic Company Ltd.
I. Jenatschstrasse
Postfach, 8027 Zurich
Switzerland
Tel: (1) 2010711
TXL: 54318

SYRIA
Mabek (Electronics Division)
P.O. Box 4238
Damascus, Syria

TURKEY
Erkman Electronik Aletler
Ticaret Anonim Sirketi
Necatiby Cad 92/3
Karakoy, Istanbul, Turkey
Tel: (1) 5461
TLX: 23353

UNITED KINGDOM
Fluke International Corp.-UK
Colonial Way
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United Kingdom
Tel: (923) 40511

U.S.S.R.
Amtest Associates Ltd.
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YEMEN
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5004 EB Tilburg, Netherlands
Tel: (013) 673973
TLX: 52237

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Amtest Associates Ltd.
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